Vol. XXIX
No. 3

PSYCHOLOGICAL REVIEW PUBLICATIONS

Whole No. 132
1921

Psychological Monographs

EDITED BY

JAMES ROWLAND ANGELL, 522 FIFTH AVE., NEW YORK
HOWARD C. WARREN, PRINCETON UNIVERSITY (*Review*)
JOHN B. WATSON, NEW YORK (*J. of Exp. Psychol.*)
SHEPHERD I. FRANZ, GOVT. HOSP. FOR INSANE (*Bulletin*) and
MADISON BENTLEY, UNIVERSITY OF ILLINOIS (*Index*)

Mental and Educational Measurements of the Deaf

BY

JEANNETTE CHASE REAMER, PH.D.

Ohio State University

PSYCHOLOGICAL REVIEW COMPANY
PRINCETON, N. J.
AND LANCASTER, PA.

AGENTS: G. E. STECHERT & CO., LONDON (2 Star Yard, Carey St., W. C.)
PARIS (16 rue de Condé)

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AMERICAN FOUNDATION
FOR THE BLIND INC.

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PREFACE

The object of this research has been not only the standardization of mental and educational tests for the deaf but also to give a brief resumé in this monograph of any work of a psychological nature bearing on the deaf. Since psychological research as applied to the training and education of the deaf has been of comparatively recent origin the material has necessarily been scattered. It is hoped that thus collecting these facts in one volume will prove helpful to future workers.

This research was carried out under the direction of Dr. Rudolph Pintner of the Ohio State University, and it is due to his most helpful criticism and encouragement that it has been carried to completion.

The writer is greatly indebted to the several superintendents for granting her the privilege of testing in their schools and residing in the institutions during the period of the work; and to principals and all teachers in the many schools visited, while collecting this material, for their hearty coöperation and many courtesies.

My thanks are due and are heartily extended to the members of the mental test class who made it possible for me to undertake a work of such extent, by their untiring assistance in scoring the papers and aiding in other clerical work.

I am pleased to thank Miss Hazel Knight for allowing me to make use of the results of her recent tests made in the Columbus School for the Deaf.

Jeannette C. Reamer.

Columbus, May 1920.

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CHAPTER I

History of the Education of the Deaf

The deaf have probably been with us always, as is evidenced from the very early date when they are mentioned in literature. Individual deaf persons are alluded to by the early Greek and Roman writers and both Plato and Aristotle speak of the deaf as a class.

For the most part they were treated kindly, but in a superstitious way, as their affliction was looked upon as a visitation of the gods, and very little attempt was made to change their condition through education. The little teaching which was done, was considered as a miracle. Attempts at cure of deafness usually had no results at all or ended in making the condition worse. Most of them amounted to a few charms and to the application of poultices to the head.

Later when the idea of physical perfection was dominant, the deaf were exposed and treated, as otherwise frail children were, and allowed to die. It was not until the Scholastic period that any concerted attempt to educate the deaf was made. At this time, with the desire for learning spreading over Europe, the deaf naturally felt the influence.

The first reference to the teaching of speech to the deaf is made by the Venerable Bede (691) who tells us that Bishop John of York taught a deaf man to speak, and he regards it as a sort of miracle. Another reference to a deaf mute speaking is made by Rodolphus Agricola (1443-1485).[1] An attempt at an invention of a manual alphabet was made as early as the sixteenth century by Girolamo Cardano (1501-1576), a physician of Pavia.[2] He also advocated the use of speech with the deaf.

[1] Fay, E. A. (Editor), "Histories of American Schools for the Deaf." Three Vols. Volta Bureau, 1893.

[2] Best, Harry. "The Deaf, Their Position in Society and the Provision for their Education in the United States." Chap. VIII. New York. Thomas Y. Crowell Co., April 1914.

Probably the best early work with the deaf was done in Spain. Pedro Ponce de Leon (1520-1584) is reported to have taught his deaf pupils not only the Spanish language but also arithmetic, Greek, Latin and astrology. Later, in 1620, Juan Pablo Bonet published a treatise on the education of the deaf and invented a manual alphabet, which is the basis of the one used at the present time. A detailed account of this plan of work is to be found in his book called, "Reduccion de las Lettras, y Arte para enseñar a hablar los Mudos."

At the same time a great deal of work was being done in England, France, Italy and Germany. In the latter country the name of Samuel Heinicke is by far the most important, in that he was the first to establish a public school. His first attempt was made at Hamburg, but the school was later moved to Leipsic, at the request of the government in 1778. He was one of the first exponents of the oral method.

Among the numerous French workers the name of Charles Michel, Abbé de l'Epée, stands above the rest. He established a school and published a number of books on the instruction of the deaf. One book is called "La Véritable Manière d'Instruire les Sourds et Muets." He was the first to elaborate the use of natural signs. Also he did more to show the public the need of instructing the deaf than any former teacher. The Abbé Sicard succeeded the Abbé d l'Epée and the works of both these men have strongly influenced the American schools.

By the beginning of the nineteenth century there were a number of schools throughout Europe, chief of which probably was the one opened in 1760 by Thomas Braidwood in Edinburgh, Scotland. The school was opened with only one pupil but soon increased in size.

The first attempt to start a school in America was made at Boston. Here a man named Francis Green, having a deaf son, took a census of the deaf in Massachusetts and finding seventy-five tried to start a school. At about the same time in Virginia, John Braidwood, son of the Braidwood of Edinburgh, was employed by William Boling to instruct his deaf children. Out

of these early attempts there grew several schools, none of which, however, proved to be permanent.

The first permanent school was established at Hartford, Connecticut, and came into being through the interest taken in Alice Cogswell, a girl of that city. A society to promote the education of the deaf was formed and decided to send Thomas Hopkins Gallaudet, a theological student abroad to study the various methods of instruction in use. The choice of Gallaudet came about naturally through his friendship with the Cogswell family and through his interest and sympathy for the deaf child. When Dr. Cogswell and other progressive citizens of Hartford formed themselves into a society they naturally turned to the young theologian. Furthermore, the importance of religious training for the deaf was dominant at that time, since the deaf were known to have very child-like ideas regarding the Deity. Peet[3] has written an interesting article on this phase of a deaf person's mind.

The methods used in England by the Braidwoods, were kept more or less secret, so Gallaudet naturally turned to France where he learned the methods of the Abbé Sicard. When Gallaudet returned from Europe the first American School for the Deaf was opened at Hartford in 1817 and was granted a $5000 appropriation by the legislature of Connecticut. So much interest was aroused by the good results obtained that Congress granted twenty-three thousand acres of public land to the school.

In other states there were many small private attempts to care for the deaf and soon these were taken over by larger societies and then incorporated by the legislature. The state of Indiana was the first to pass a law making the deaf school free to all, not just the indigent. Only thirty-seven years after the founding of the first school in America there were schools in seventeen states.[4] At first there were very few children coming to the schools, so the promoters had to go out and convince the parents

[3] Peet, H. P., "Notions of the Deaf and Dumb before Instruction, Especially in Regard to Religious Subjects," *American Annals of the Deaf and Dumb,* Vol. VIII, No. 1, 1855, pp. 1-44.

[4] Best, Harry, *op. cit.,* p. 144.

of the need of educating their deaf children. The age limits were high and the period of attendance was short, usually from two to four years.

Although the main idea in establishing schools for the deaf has always been that of teaching, there was some idea of caring for these "unfortunates" in other ways. Therefore these schools were for the most part called asylums, a rather misleading and unfortunate term. In the course of time, as these institutions became free and supported in one way or another by the state, and as the emphasis upon education grew, the term "school" was brought into more general use.

The next step was the establishment of public day schools under the Boards of Public Education. The Horace Mann School in Boston, established in 1869, was the first public day school. From this time onwards the number of public day schools has steadily increased. In these schools the deaf children are under the same regulations as the hearing child, living at home with their parents. In most states deaf children are now compelled to go to school and are included under the truancy laws just as hearing children. There were listed seventy-eight day schools in the United States in October 1919.[5]

The one point in the work without precedent in other countries was the establishment in 1864 of Gallaudet College or Columbia Institution for the Deaf supported by Congress. This is the only college exclusively for deaf students.

All the schools have some industrial work which is found to be even more essential for the deaf than for hearing children since they must be taught a means of earning a livelihood. This is accomplished more easily in the schools than it is later by people who do not understand the abilities or limitations of the deaf. Gallaudet College, recognizing this need, is considering the adoption of certain industrial courses in its curriculum.

There are still three methods of teaching in use throughout the country today. First the manual and sign method modelled on the French, and the original method in the United States. Second the oral method, which was most favored in Germany. The

[5] *American Annals of the Deaf,* Vol. LXV, No. 1, January 1920, pp. 1-22.

supporters of this method held that any child who can be educated at all, can be educated in language. Max Müller said, "without speech, no reason." Connected with this form of teaching is articulation, or learning to manipulate the vocal cords. Melville Bell and his son Alexander Graham Bell are the great exponents of this method in this country. The third method is known as the combined system, which makes use of both the oral and manual methods.

The Day schools are using almost exclusively the oral methods, thus enabling their students to be more adaptable when going out among speaking people. The importance of this adaptability is emphasized in an article by Lloyd[6] when he writes, "It is important that the deaf child learn to adapt himself to his environment and to other people and learn to follow directions."

The combined method is still continued in many of the larger schools, as it is perhaps easier and more natural when the deaf are thrown with the deaf.

The aim of this study is not to make a plea for any particular type of school or special method of teaching, because, as Davidson so aptly put the idea, "Not language *per se,* but the use of it to get ideas, is the important point."[7] Whichever method or combination of methods produces this desired result with the type of student material attending a particular school, is the best method to use.

[6] Lloyd, W. H., "The Deaf in Relation to Others," *American Annals of the Deaf,* Vol. LXII, No. 2, March 1917, pp. 112-121.

[7] Davidson, Samuel G., "Observations on Language Methods," *American Annals of the Deaf,* Vol. LXII, No. 4, September 1917, pp. 308-320.

CHAPTER II

History of Psychological Investigations with Regard to the Deaf

This chapter rightly should begin in the early ages, when special attention was directed toward the deaf only with the idea of saving their souls. In order to accomplish this end it was thought that the deaf child must be taught to repeat and understand the Creed and Commandments of the Church.

Among the early writings concerning the deaf, much space is given to relating the naïve ideas of the uneducated deaf, regarding natural phenomena and divine power.[1] The same idea has dominated or influenced a great deal of the teaching even up to the present time. Diderot[2] gives a rather interesting story of one deaf child who thought a musical instrument an additional means of speech, since people listen to it, as they would to the talking of others. These ideas are interesting since they show the same type of reasoning as primitive man displays in his attempt to explain natural phenomena in terms of his everyday existence.

The first step in the direction of modern psychological views was made by a physician, Alexander of Aphrodisius,[3] as early as the third century. He formulated the opinion, which we all now know is a fact, that most children are dumb because they do not hear and not necessarily because the organs of speech are affected. This represented, perhaps, the beginning of the association theory.

Some German writers have emphasized the brain defects which

[1] Peet, M. P., "Notions of the Deaf and Dumb before Instruction, especially in regard to Religious Subjects," *American Annals of the Deaf*, Vol. VIII, No. 1, 1855, pp. 1-44 and also Clerc, L., "Visits to some of the Schools of the Deaf and Dumb in France and England," *American Annals of the Deaf*, Vol. I, No. 2, 1848, pp. 113-120.

[2] Diderot, D. "Lettre sur les Sourds et les Muets." Oeuvres Complètes par J. Assèzat. Vol. I, Paris, 1875, pp. 343-428.

[3] Love, J. K., "Deaf Mutism," Glasgow, 1896, J. MacLehose and Sons.

also cause deafness and mutism, such as certain forms of aphasia. Quoting from Adolf Strumpell,[4] who says, "In spite of perfect hearing apparatus some are deaf and dumb because the central associations are out of order, especially the paths associating form and verbal name."

The early systems, as far as they are known, are based on the idea of making the remaining senses function in the place of the missing sense, through association. Bain[5] writes, "It is in associating names at once with their objects or meanings that the acquisition of language proceeds most rapidly." This principle was followed in developing the so-called Natural or Logical System, also sometimes named Mother Method, since the mother tongue of a hearing child is acquired in the same way.

As for applying psychological principles to the practical end of classifying deaf children, Greenberger[6] was the leader. His method was to show the children bright colored pictures and note their reaction or to watch their constructive ability with blocks, and thus in a rough subjective fashion differentiate them with regard to general ability. From this time on the literature on the deaf abounds with references to classification or the need of it.[7] In an article in 1905 by Ferreri[8] we find this question raised, "How can one be sure that intelligence is lacking in an individual if he has never had an opportunity of manifesting it by the ordinary ways of sensitive reactions?" He answers his own question by saying, "that the science of education must be subordinate to the studies and researches of experimental psychology."

[4] Strumpell, Adolf, "Die Entwicklung der Sprache und die aphatischen Sprachstörungen," *Zeitschrift für Pädagogische Psychologie und experimentelle Pädagogik*, Vol. XVII, Jan. 1916, pp. 5-21.

[5] Bain, Alexander. "Education as a Science." London, 1892. C. K. Paul & Co.

[6] Greenberger, D., "Doubtful Cases," *American Annals for the Deaf*, Vol. XXXIV, No. 2, 1889, p. 93.

[7] Love, J. K., "The Classification of Pupils in Denmark," *American Annals of the Deaf*, Vol. LII, No. 1, 1907, pp. 114-116.

[8] Ferreri, G., "The Development of Intelligence in the Case of One Deprived of both Sight and Hearing." Rome, Italy. Translated in *The Association Review*, Vol. VII, 1905, pp. 440-448.

MacMillan[9] attempted to answer two questions regarding every deaf child entering the Chicago schools. First, what are the degrees and kinds of defects in the organ of hearing? For this he gathered as much family history and life history of the child as possible, to add to the results of tests of grip and tapping ability and physical measurements. Second, what is the degree of normality of intelligence of the child? In order to avoid the use of the sense of hearing the mental tests were of motor and visual-motor character, such as discrimination of size and form, distance, direction, color and brightness.

Yearsley[10] writes that the need for classification is very great among the deaf. He would divide all deaf into four classes; slightly deaf, semi-deaf, very deaf and defective deaf. The system must be fitted to the child. The more hearing and mentality a deaf child has, the quicker he will learn lip-reading, and, therefore, he will profit most by the oral method. However, no objective methods were given for the classification of the deaf defectives.

Stern[11] recognized the need of a differentiation of scales for children of different social strata, for the two sexes and especially of a series of tests devoid of the speech factor for the testing of the deaf and dumb.

Long[2] in writing of the exceptional child discusses the advantages of tests, especially performance tests, used with the deaf in order to find the child's special bent.

A recent article by Gruver[13] even goes so far as to urge the separation of the "peculiar" child from the normal and the strictly feeble-minded. But he does not say how he proposes to do it,

[9] MacMillan, D. P., "Laboratory Methods for Determining the Status of Deaf Children." *Association Review,* Vol. XI, No. 4, October 1909, pp. 326-332.

[10] Yearsley, Macleod, "The Classification of the Deaf Child for Educational Purposes," *Child Study,* Vol. VII, 1914, pp. 144-149.

[11] Stern, L. W., "Psychological Methods of Testing Intelligence." Trans. by G. M. Whipple, Baltimore. Warwick & York, 1914.

[12] Long, J. Schuyler, "The Exceptional Child," *American Annals of the Deaf,* Vol. LXII, No. 2, March 1917, pp. 154-164.

[13] Gruver, Elbert A., "The Subnormal Deaf," *American Annals of the Deaf,* Vol. LXIV, No. 4, September 1919, pp. 298-305.

mentioning only the establishment of a normal test or status for the deaf which is being handled by a Committee of the Conference of Superintendents and Principals of American Schools for the Deaf.

A few single psychological and educational tests have been attempted from time to time among deaf students. Such was a free association test by Taylor,[14] by means of which he wished to make comparisons of the spelling ability of deaf with hearing children. This comparison was rather to the advantage of the deaf child, in that, in fifteen minutes the deaf wrote one hundred and fifty words with only 2.7 percent errors, while the hearing pupils wrote one hundred and fifty-three words with 4.3 percent errors.

Another work undertaken with the idea of making comparisons between deaf and hearing children is that of Mott.[15] Her tests consisted of anthropometric measurements and physical tests with only two strictly psychological tests, namely tests of memory and observation. The conclusions drawn are that the deaf child is equal physically and equal, if not really superior, in observation and memory.

Another memory test was carried out by Smith,[16] using a story. His work is rather vague and his conclusions general. He implies that only the children having good memories reach the upper classes, that poor pupils have poor memories, that there are no marked sex differences and that finger spelling while studying does not seem to have any bearing on the results.

MacMillan and Bruner[17] made a comprehensive study of one hundred and eighty-four children in the Chicago public school system. The tests used were mainly physical tests and such mental

[14] Taylor, H., "A Spelling Test," *American Annals of the Deaf,* Vol. LXII, 1897, pp. 364-369.

[15] Mott, A. J., "The Ninth Year of a Deaf Child's Life," *American Annals of the Deaf,* Vol. XLIV, 1899, pp. 401-412, and Vol. XLV, 1900, pp. 33-39.

[16] Smith, J. L., "Mental Characteristics of Pupils," *American Annals of the Deaf,* Vol. XLVIII, 1903, pp. 248-268.

[17] MacMillan, D. P., and Bruner, F. H., "Children Attending the Public Day Schools for the Deaf in Chicago." Special Report of the Department of Child Study and Pedagogic Investigation. Chicago Public Schools. May 1906.

tests as cancellation of As, perception of size by sense of touch, sensitivity for lifted weights and some memory tests. The deaf were inferior to the hearing in every test with the exception of sensitivity for lifted weights and here they were just about equal, although these children were selected so as not to include any feeble-minded and only a very small percentage of slow pupils. The conclusion drawn was that these deaf children were simply immature and that they would eventually catch up with the hearing. These findings are in direct antithesis to the results of Mott's research referred to above, but very much the same as the more recent investigations by Pintner, although the conclusions drawn are somewhat different, since Pintner concludes that on the average the deaf never attain the level of hearing children.

Two comparatively recent articles written by psychologists dealing with the deaf are by Bolton and Kitson. Bolton's[18] article is on the value of muscular movement for our knowledge of the world. He shows how most of our intellectual development goes back to skin and muscle senses. Because of this fact, it is possible to educate the deaf-blind. From an autopsy of Laura Bridgeman's brain it was discovered that the tactual and muscular perception areas were greatly over-developed, while the visual and auditory centers were shrunken. The paper by Kitson[19] has to do with the use of certain tests for choosing children who will be good lip-readers.

Binet and Simon[20] in 1910 published an article on the relative merits of the oral and manual methods of teaching the deaf, which aroused a great deal of discussion among the advocates of the two methods. Binet's method was to follow up as far as possible the graduates of an oral school in Paris and find out whether they were making any use of speech and lip-reading. He found that most of these graduates made such little use of

[18] Bolton, T. L., "The Psychology of the Education of the Deaf-Blind," *American Annals of the Deaf,* Vol. LX, 1915, pp. 222-227.

[19] Kitson, H. D., "Psychological Tests for Lip-reading Ability," *The Volta Review,* Vol. XVII, No. 12, 1915, pp. 471-476.

[20] Binet, A., and Simon, Th., "Oral and Manual Methods of Teaching the Deaf," *L'Année Psychologique,* Vol. XV, 1909, pp. 373-396. Trans. *American Annals of the Deaf,* Vol. LV, 1910, pp. 4-33.

these acquirements as to justify him in his conclusion that the oral method was a waste of time. It must be said, however, that relatively few cases were studied by Binet and that the supporters of the oral method found much to criticise in his method of investigation.

From this brief outline of the progress of psychological experimentation with the deaf, we see how theoretical most of the work had really been. The value of better methods of classification was appreciated, but no adequate objective means of classifying children had been suggested.

About 1906 the stimulus given the classification of hearing children, by the Binet tests, was reflected in the deaf schools. The emphasis was placed in the beginning on the defective deaf because they are the children who demand the most attention from the teacher and make the slowest progress. In 1909 there were reported one hundred feeble-minded deaf in Ohio but no statement is made as to how they were recognized. If those reported were only the obvious cases, as it is most likely, there probably remained a considerable percent of higher grade or borderline cases. This type is difficult to detect even among hearing children. They need not necessarily be confined in institutions but they do need special classes and training.

Since this segregation of the defective has been more or less accomplished in many deaf schools, the benefits of better classification of the normal deaf children have been stressed more recently. Kilpatrick[21] was the first to propose the use of the Binet-Simon Tests or some modification of them with deaf children. He published two articles on the subject, one in 1912 and the other in 1914. One of his aims was to measure the amount of retardation of the deaf child in contrast with the hearing. His suggestion was to have a commission appointed for making a complete standardization of the Binet Scale for deaf children. He himself did not publish any attempt to modify the Binet Scale for this purpose.

The first actual work of adapting scales especially for the

[21] Kilpatrick, W. M., "Comparative Tests," *American Annals of the Deaf,* Vol. XVII, 1912, pp. 427-428, and also Kilpatrick, W. M., "Mentality Tests," *American Annals of the Deaf,* Vol. LIX, 1914, pp. 394-398.

deaf was done by Pintner and Paterson.[22] The writers first made a preliminary study of the possibilities of the use of the Binet Scale with deaf children. They concluded there were three main difficulties; (1) lack of comprehension (2) lack of environmental experience (3) difficulties due to the peculiar psychology of the deaf. These conclusions were reached even after giving the child every advantage, that is, of lip-reading, signs or written language, in the explanations.

As another possible approach to a means of measuring the ability of deaf children, a group test was tried.[23] The Digit-Symbol test seemed the best to use since it required little language in the demonstration. In the comparisons made with Pyle's norms for hearing children, the writers found an extremely large percentage of dull children. These results were not very satisfactory but the experiment showed the possibility of the use of class tests.

From these trials it was evident that if psychological measurements were to be applied to the deaf, special tests of some kind must be devised. This led to the trying out of certain form boards with the deaf.[24] The results showed that the deaf more nearly approached the standards of young hearing children on this type of test, in which they were asked to do something with their hands. This fact had already been noticed by a German psychologist, Matz,[25] who used certain tests in which the children were asked to draw and model. After comparing hearing children in two different types of German schools he compared the deaf and blind with these and found the deaf rated best of the four groups.

While giving individual performance tests, Pintner and Pater-

[22] Pintner, R., and Paterson, D. G., "The Binet Scale and the Deaf Child," *Journal of Educational Psychology,* Vol. VI, No. 4, April 1915, pp. 201-210. *American Annals of the Deaf,* Vol. LX, No. 4, September 1915, pp. 301-311.

[23] Pintner, R., and Paterson, D. G., "A Class Test with Deaf Children," *Journal of Educational Psychology,* Vol. VI, December 1915, pp. 591-599.

[24] Pintner, R., and Paterson, D. G., "The Form Board Ability of Young Deaf and Hearing Children," *Psychological Clinic,* Vol. IX, January 1916, pp. 234-237.

[25] Matz, W., "Zeichen und Modellierversuch an Volkschülern, Hilfschülern, Taubstummen und Blinden," *Zeitschrift für Angew. Psychologie,* Vol. 10, 1915, pp. 62-135.

son were impressed with the tediousness of testing a whole school and the necessarily great amount of time which would be consumed. They, therefore, concluded to attempt again, some class or group test with the deaf. The Digit-Symbol and Symbol-Digit learning tests[26] were used for this purpose. Each test consists of ten circles at the top of the page, with a symbol and digit in each circle. Below on one sheet there are series of digits to have the corresponding symbol supplied; on the other the symbol is given and the digit is to be supplied. These two tests were used because of the fact that very good norms for hearing children had already been published and furnished a good basis of comparison between hearing and deaf. Also no language ability was necessary for their performance, since this was an attempt to measure native ability, not school attainment. The conclusions drawn by Pintner and Paterson as a result of these group tests, are: (1) The deaf child is about three years behind the hearing child in learning ability, as tested by the rapidity and accuracy of forming associations between numbers and forms; (2) The deaf boy is equal in learning ability to the girl, differing in this respect from the hearing boy who falls below the hearing girl; (3) The deaf boy approximates the hearing boy more closely than the deaf girl approximates the hearing girl in learning ability; (4) The congenitally deaf and the adventitiously deaf are equal in learning ability. Because of the great similarity of the results on both tests, in all three institutions tested, the conclusions may be considered very reliable.

Newlee[27] tried the same tests on eighty-three deaf children in the Chicago schools. The number of children at each age was so small that the distribution curve was very irregular but did approach that for hearing children more nearly than that given by Pintner and Paterson. However, the deaf children found in the public school system of Chicago are a very select group and certaintly not the same type as is found in the ordinary institution.

[26] Pintner, R., and Paterson, D. G., "Learning Tests with Deaf Children," *Psychological Monographs,* Vol. XX, No. 4, February 1916; Whole No. 88.

[27] Newlee, Clara E., "A Report of Learning Tests with Deaf Children," *Volta Review,* Vol. XXI, No. 3, 1919, pp. 216-223.

With some of the tests which Pintner and Paterson had been using previously with deaf children, they were asked to make a survey of a public day school in Grand Rapids.[28] Thus they were able to prove some of the benefits derived from such surveys. The results showed this school to have a large number of dull children and that, therefore, the school should not be condemned if the educational work was inferior.

Later with the coöperation of the superintendents of four institutions Pintner and Paterson undertook the application of the Trabue Language Completion Test.[29] This test was devised for hearing children and is an excellent test of language ability. The idea is the same as that used in class room language work in most deaf schools, namely, the supplying of suitable words in incomplete sentences. Since the use of language is admittedly the most important factor in the education of the deaf, these test results threw some light on the amount of language ability of deaf children in contrast with hearing. In every case the results were lower for the deaf.

Later on Pintner[30] repeated the Trabue tests on many of the children in order to get some measure of language progress. This he found to be very slow in comparison with the progress in language development, as measured by the same test on hearing children.

The ability of the deaf to follow printed directions was measured by Pintner and Paterson,[31] using the Woodworth and Wells Directions Test. The writers concluded that these tests measured the ability to comprehend language rather than ability to carry out the directions, in the case of both the deaf and the young hearing children. The average deaf child's ability to com-

[28] Pintner, R. and Paterson, D. G., "The Survey of a Day School for the Deaf," *American Annals of the Deaf,* Vol. LXI, November 1916, p. 417-433.

[29] Pintner, R., and Paterson, D. G., "A Measurement of the Language Ability of Deaf Children," *Psychological Review,* Vol. XXIII, November 1916, pp. 413-436.

[30] Pintner, R., "Measurement of Language Ability and Language Progress of Deaf Children," *Volta Review,* Vol. XX, Decmeber 1918, p. 755.

[31] Pintner, R., and Paterson, D. G., "The Ability of Deaf and Hearing Children to Follow Printed Directions," *Pedagogical Seminary,* Vol. XXIII, December 1916, pp. 477-497. Also in *American Annals of the Deaf,* Vol. LXII, No. 5, November 1917, pp. 448-472.

prehend the language involved, was about equal to that of a six or eight-year-old hearing child.

Deaf children on the whole have a very poor memory span,[32] probably, partly due to their lack of auditory experience. The deaf child does not have the experience of mentally hearing the digits spoken, as they are brought into the visual field. Also, if he is congenitally deaf, he does not have kinaesthetic sensations in the speech muscles. These aids to memory, which a hearing child has, enable him to remember more digits than a deaf child.

As an outgrowth of all this previous research, Pintner and Paterson[33] devised a scale of performance tests. This time we have individual tests, arranged especially for the deaf. The series consists of several separate performance tests, that is, tests which do not require any knowledge of language and which can be administered by using only natural signs. The child is required to do certain things with his hands, fit blocks together in such a way as to make a completed whole, and the like. Each test is to be completed within a specified time and the entire series does not occupy more than one half to three quarters of an hour to give. This series has the advantage of being of interest to and suitable for very young children entering the kindergarten or first grades.

The Performance Scale was revised and shortened in 1918 by Spaid,[34] thus cutting down the time of administering it to twenty minutes or half an hour.

The best summary of psychological testing of deaf children up to 1917 is to be found in two articles by Pintner and Paterson. The first one[35] outlines the growth of interest in psychological tests and the most important and fruitful experiments which had been performed up to that time.

[32] Pintner, R., and Paterson, D. G., "Comparison of Deaf and Hearing Children in Visual Memory for Digits," *Journal of Experimental Psychology,* Vol. II, February, 1917, pp. 76-88.

[33] Pintner, R., and Paterson, D. G., "A Scale of Performance Tests." D. Appleton & Co., New York, 1917.

[34] Spaid, J. D., "A Shortened Performance Scale," A. M. Thesis, Ohio State University, 1918.

[35] Pintner, R., and Paterson, D. G., "Psychological Tests of Deaf Children," *Volta Review,* Vol. XIX, No. 12, December 1917, pp. 661-667.

The second article[36] summarizes the results of the writers' findings on the various tests which they had given, and seeks an explanation for these facts. The application of such tests as the Performance Scale to deaf children, as a means whereby more efficient and more economical administration of schools could be effected, is discussed and urged.

The value of classification was brought out in an article by Pintner,[37] in which he discussed the theoretical grouping of a number of children in the same grade. These children were found divided into four groups, showing a range of mentality from the lowest to the highest in the whole group in the same class. If these same children had been grouped according to some objective means, such as mental tests, they could have been arranged in more homogeneous groups as Pintner demonstrated, making the work much simpler for the teacher and more beneficial for the child.

Porteus[38] tried out his scale of maze tests on a small group of deaf and dumb children in the school at Melbourne, Australia. His procedure was to illustrate the task by a test at a lower level than the child was expected to reach, and thus to eliminate the language factor. His conclusion was that such tests could be used with deaf children as an aid to estimating intelligence and educability.

As a corrollary to these investigations into the mentality and educational attainments of deaf children, some questions of the mentality of the families of these children have been raised. Pintner and Osborn[39] investigated the families of a number of the congenitally deaf children in the Ohio Deaf School and found a great number of other defects indicative of a neurotic constitu-

[36] Pintner, R., and Paterson, D. G., "Some Conclusions from Psychological Tests of the Deaf," *Volta Review,* Vol. XX, No. 1, January 1918, pp. 10-14.

[37] Pintner, R., "The Value of Mental Tests in the Classification of Pupils," *American Annals of the Deaf,* Vol. LXIII, March 1918, pp. 196-204.

[38] Porteus, S. D., "The Measurement of Intelligence: Six Hundred and Fifty-Three Children Examined by the Binet and Porteus Tests," *Journal of Educational Psychology,* Vol. IX, No. 1, January 1918, pp. 13-31.

[39] Pintner, R., and Osborn, D., "The Mentality of the Families of the Congenitally Deaf," *American Annals of the Deaf,* Vol. LXIV, March 1919, pp. 96-134.

tion. These other defects probably denoted weaker and more unstable constitutions than are found in the families of average hearing persons. Fay[40] reached much the same conclusions in his earlier work on the heredity of the deaf.

Schuster,[41] using Fay's data, investigated the inheritance of deafness, from the father and from the mother. His results were about the same for deafness as for any other parental inheritance, that is, correlations between deafness in fathers and children gave coefficients from .46 to .62, between mothers and children coefficients from .45 to .62.

Some phases of the tests reported in the present work were discussed by Pintner[42] at the Conference of Superintendents and Principals in Columbus, December 1-4, 1919. The application of tests to school problems and the use of charts was discussed in detail.

The present work is the first attempt to arrange a scale of group tests for the deaf and to let the deaf children themselves set the standards of performance. In other words a given child is always measured against children of the same chronological age, as a measuring rod. Suppose we have tested two hundred nine-year-old children and have a score for each child which represents his ability on the test series. Now a new nine-year-old child is given the test. Does his score correspond with the lowest, 10th from the lowest or 5th percentile child, middle or top child? Is he poor, average, superior or highest? Without such tests there is no way of adequately classifying a child until he has spent six months or a year in the school. Even then, if the child is a particularly difficult case, there would be a possibility of wrong classification. With psychological tests as an aid we hope to save some of this time and to establish a more reliable means of grouping the children.

[40] Fay, E. A., "Marriages of the Deaf in America," Volta Bureau, Washington, D. C., 1898.

[41] Schuster, E., "Hereditary Deafness," *Biometrika,* Vol. IV, 1905-6, pp. 465-482.

[42] Pintner, R., "Deductions from Tests of Mentality in Schools for the Deaf in Comparison with Schools for the Hearing," *Volta Review,* Vol. XXII, No. 4, April 1920, pp. 197-207. Also in *American Annals of the Deaf,* Vol. LXV, No. 3, May 1920, pp. 278-300.

CHAPTER III

The Tests

Two series of tests were used in this research; the one called a Non-Language or Mental Scale, the other an Educational Scale. Both series are composites of longer standardized tests with the exception of the first, fifth and sixth tests in the Non-language Scale.

Non-Language Scale.

The first test in the Non-language series is the Imitation test, based on the idea of the Knox Cube test and adapted for class use. Immediate memory, visualization and concentration are probably the predominating factors brought into use by this test.

In this test four dots are drawn on the board corresponding with the dots on the sheet before the child. With a pointer the examiner traces a line connecting those dots in a given sequence. The children then draw with pencil the same sequence on their papers.

A preliminary trial was made, using twenty-five lines, on several classes in a grade school. The percentage of correct answers for each line were arranged in order of rank. Then twelve lines were finally selected of approximately equally increasing degrees of difficulty. The first few lines are sufficiently simple for second and third grade children while the last two tax the ability of high school pupils and adults.

The second test in this series is the Easy Learning test, which consists of three squares at the top of the page, each containing a simple sign and digit. The remainder of the page is filled with squares, each containing a sign, under which the child must put the digit belonging to that particular sign. There are fifty squares to be filled.

All three laws of learning are measured by this test, that is, immediate memory of the signs and digits, retention and recall

at the proper time. The child who does not memorize the key at the top of the page greatly retards his speed and lengthens his time by looking back each time for the appropriate sign.

The third test is a more difficult Learning test, that is, there are nine different signs instead of three. The page is arranged in the same form as in the preceding test so that, with the Easy Learning test as a sample test, the Hard Learning is easily understood. There are also fifty squares on this page, to be filled. The same factors are being measured as with the simpler test. These two learning tests test the rapidity of the formation of new associations, a function that is basic in all learning.

The fourth test is a Drawing Completion test, devised by Pintner, consisting of ten drawings with a sample at the top of the page. Each picture has some essential part left out, which the child must supply. The pictures are such simple line drawings that no special artistic ability is necessary for their completion and no account is taken of the way a part is drawn, if it indicates a correct completion. Observation is perhaps the most prominent factor measured by this test.

The fifth test is known as a Reversed Drawing test, suggested by Toops. It consists of a series of ten complete geometrical figures. Each drawing has two heavy lines. Opposite each figure the two heavy lines are repeated in such a way, that when the drawing is completed, the figure will either be up-side-down or in a reversed position from the drawing on the left.

The ability to visualize the drawing in the inverted position is a necessary factor in this performance, if the higher mental process is not employed. The reasoning consists in discovering that the drawing will be up-side-down if the lines traced on the completed picture are drawn in exactly the opposite direction. A rather high degree of observation also seems necessary before a child grasps the significance of the heavy line, in the completed picture, being identical with the given lines on the opposite side.

The sixth and last test we have called Picture Reconstruction. The idea of a picture puzzle is utilized but as it was to be given as a class or group test other methods had to be used. The pieces are scattered about and numbered as they were arranged 1, 2, 3,

4, etc. Opposite each picture are squares containing the corresponding number of spaces. In these spaces the child is required to put the number of the part, belonging in the space, to make a complete picture.

The ability to put together the various parts of a picture, as in a puzzle, is a necessary element of this performance. However the trial and error method used in matching up the different pieces is eliminated, with the power of visualization or reasoning substituted, reasoning if the lines of the different parts properly fit together.

In both of these last tests longer series were tried out first and the final series of reversed drawings and pictures selected in the same way as described for the first test. The aim was to make each test within the series proceed from something very simple to a task difficult enough to tax the ability of an adult, except in the two learning tests, which measure speed and accuracy of performance, where the degree of difficulty is the same all through each test.

The exact directions for giving the Survey Tests are found in Chapter V.

It will be noticed that very little talking is done and that it is non-essential except as being more natural with hearing children, so that the deaf child is at no disadvantage as far as the directions are concerned. Where children were not good lip readers, the writer used the signs for "name" and "age," to save time. Tapping on the floor was sufficient for attracting attention and the sign for "stop" used at the end of the time limit. Otherwise only natural gestures were needed. The writer had no difficulty in making herself understood even in pure manual classes.

Educational Scale

All the tests in this series are adaptations of well arranged and standardized tests. The shortened scales are composed of identical parts of the long scales. These parts were chosen at more or less equi-distant steps so that each test begins with an

easy problem and ends with something difficult. For further details of the arrangement of this scale reference can be made to an article by Pintner and Fitzgerald.[1]

These shortened scales, correlated with the longer series from which they were derived, give coefficients ranging from .41 to .68. The correlation between all the long tests and the whole short form was .80. The writers conclude that these are satisfactory correlations and give fairly good results when the object is to ascertain individual differences in the separate school subjects or at least they indicate where further investigation would be necessary.

The first test is taken from Thorndike's Visual Vocabulary Scale.[2] This consists of a series of disconnected words under which the child must write certain letters according to the meaning of the word. The ability to grasp the meaning of the printed instructions seems particularly difficult for the deaf child in this test, because he generally fails to read all of them. Some of the words are difficult for deaf children but that only means that it is a better test for the more advanced deaf child.

The Arithmetic test in this scale is derived from the Woody Scales[3] measuring the four fundamental processes. No explanation is necessary and almost all children are able to answer correctly at least one or two of the problems on this page.

The third test is a measure of comprehension, requiring reading ability, taken from the Kansas Silent Reading Tests by Kelly.[4] Here the child is told to do a certain thing but must be able to choose the right from among several possibilities. The greatest

[1] Pintner, R., and Fitzgerald, F., "The Use of Abbreviated Forms of Some Standard Educational Measurements, *Journal of Educational Psychology,* Vol. XI, No. 4, April 1920, pp. 207-223.

[2] Thorndike, E. L., "Measurement of Achievement in Reading: Word Knowledge." *Teachers' College Record,* November 1916.

[3] Woody, C., "Measurements of Some Achievements in Arithmetic," *Teachers' College Contributions to Education,* No. 80, 1916. Also Woody, C., "Measurements of Some Achievements in Arithmetic," *School and Society,* Vol. 4, August 1916, pp. 229-303.

[4] Kelly, F. J., "The Kansas Silent Reading Tests," *Journal of Educational Psychology,* Vol. VII, February 1916, pp. 63-80.

difficulty for the child in this test is to follow the directions accurately and do exactly what he is told.

The fourth test is taken from Thorndike's Scale Alpha.[5] The person being examined is required to read short paragraphs, one at a time, then to answer several questions relative to each. Comprehension of the meaning of what he is reading is one of the most difficult things to teach a deaf child. This test is a good measure of the child's progress in the comprehension of reading matter.

The fifth test is based on the Trabue Language Completion Scales.[6] The student must insert one word in each blank to make a complete sentence. This test is so much like the drill given the children in the class room that the only difficulty the writer had was in making the child understand that he is to write only one word in each blank.

Starch's Punctuation and Grammar Scales[7] were used as the sixth test. This test is difficult because of the word "punctuate" used in the explanation. However again, considering the understanding of the explanations as part of the test, this measures the degree of advancement of the upper grade student.

The seventh test is taken from the Hahn-Lackey Geography Scale.[8] Most of the questions are on simple geographical facts combined with a few questions on physical geography. These proved to be quite difficult since physical geography is not a part of the regular curriculum in most deaf schools but is introduced only incidentally.

The last test of this series is taken from the American History

[5] Thorndike, E. L., "An Improved Scale for Measuring Ability in Reading," *Teachers' College Record,* Nov. 1915, Vol. 16, pp. 31-53. Also Jan. 1916, Vol. 17, pp. 40-67.

[6] Trabue, M. R., "Completion Test Language Scales," *Teachers' College Contributions to Education,* No. 77, 1916. Also: Trabue, M. R., "Some Results of a Graded Series of Completion Tests," *School and Society,* Vol. 1, April 1915, pp. 537-540.

[7] Starch, Daniel, "The Measurement of Achievement in English Grammar," *Journal of Educational Psychology,* Vol. VI, pp. 615-626.

[8] Lackey, E. E., "A Scale for Measuring the Ability of Children in Geography," *Journal of Educational Psychology,* Vol. IX, October 1918, pp. 443-451.

Scales of Van Wagenen.[9] Several of the questions in this test are sufficiently easy to be answered by those children who have never studied history proper, since they cover questions pertaining to Washington, Lincoln and the Indians, subjects they have discussed in other relations.

The printed directions for each test are at the top of each page. With a few simple signs the deaf child is easily made to understand that he is to read the directions. The time required for this reading was taken account of and is included within the time limits of each test.

The two series are printed in separate booklets. Every other test in each booklet is printed up-side-down, so that there is very little chance for a child to study the next test if he chances to finish the preceding page before the time limit is up. Also it prevents distraction and correction of mistakes on the opposite page. Copies of the test blanks are reproduced at the end of this chapter.

The fact that one set must be collected and another passed out serves as a sufficient rest period for the children so that the whole test requires only about an hour to an hour and a quarter for the giving.

In order to facilitate the scoring and make it more objective, stencils were made for the Non-language tests and cards containing the correct answers for the Education Series.

The final point to be mentioned in this chapter is the question of weighting the crude scores. The various functions required for the performance of the Non-language Series seemed of about equal importance. This meant that each total possible test score must be multiplied by some number which would give each test approximately the same numerical value. In this case each possible score was multiplied by whatever number gave a product nearest 100, making a total of 601 points, as follows:

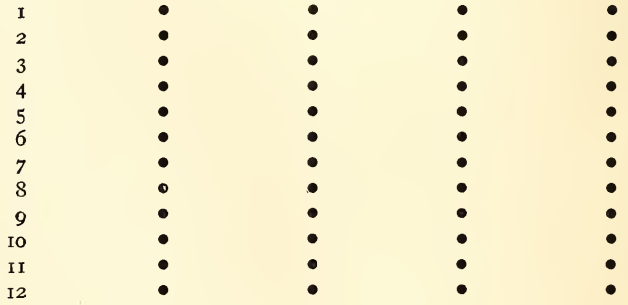
[9] Van Wagenen, M., "Historical Information and Judgment in Pupils of Elementary Schools," *Teachers' College, Contributions to Education*, No. 101. New York, 1919.

Test	Crude Score	Weight	
I	12	9	= 108
II	50	2	= 100
III	50	2	= 100
IV	20	5	= 100
V	10	10	= 100
VI	31	3	= 93
	Total.....		601

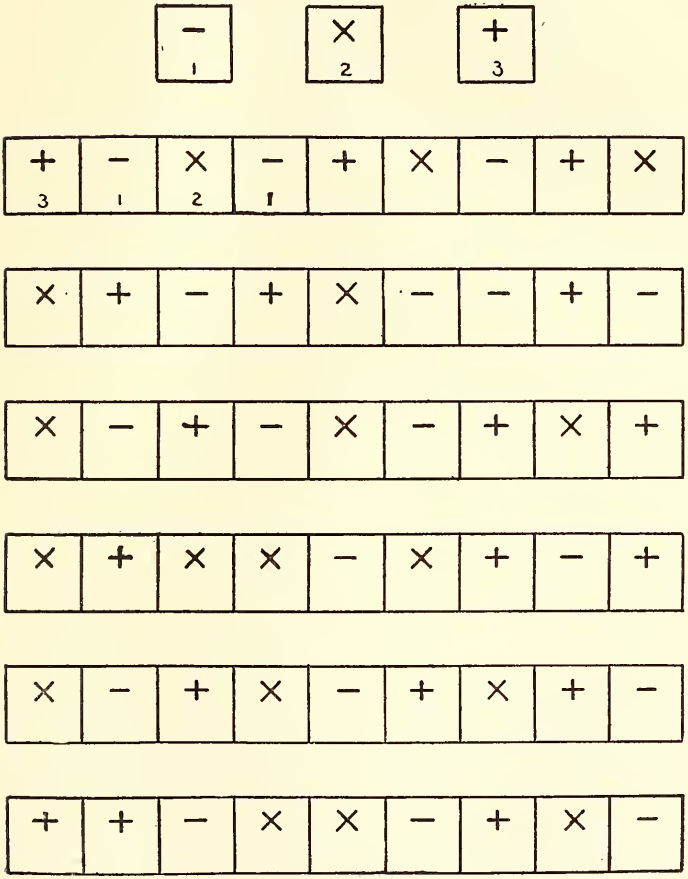
The weighting of the Educational Scale is accomplished partly through the scoring. The school subjects were ranked in order of importance and then the Educational Scale weighted accordingly. Language being the basis of work with the deaf, it was given the most weight by using three slightly different types of reading tests. Arithmetic, being next in importance, was weighted by being given two points for each correct answer. The geography and history were considered as sufficiently weighted as their original scores stood, while the grammar and vocabulary tests were combined but considered as least important. The sum of the weighted scores gives a total of 141 points.

NON-LANGUAGE SURVEY TESTS

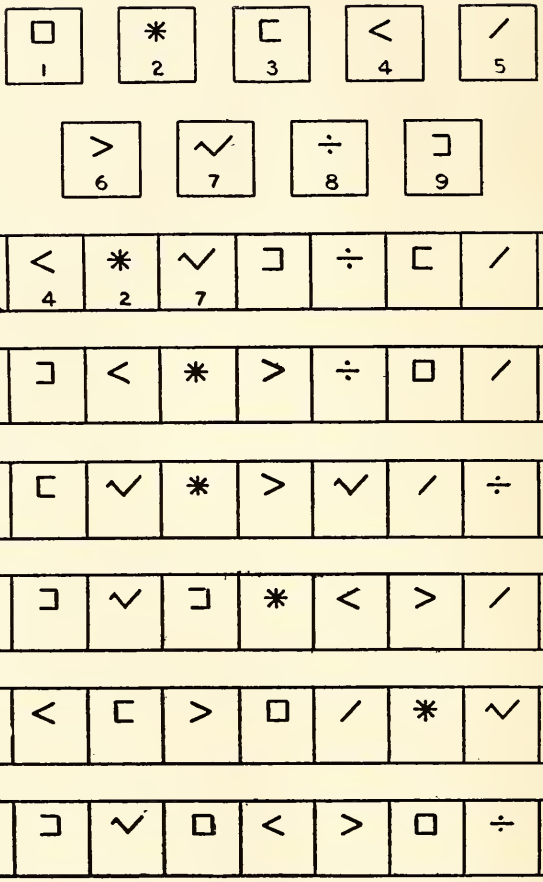
TEST 1



TEST 2

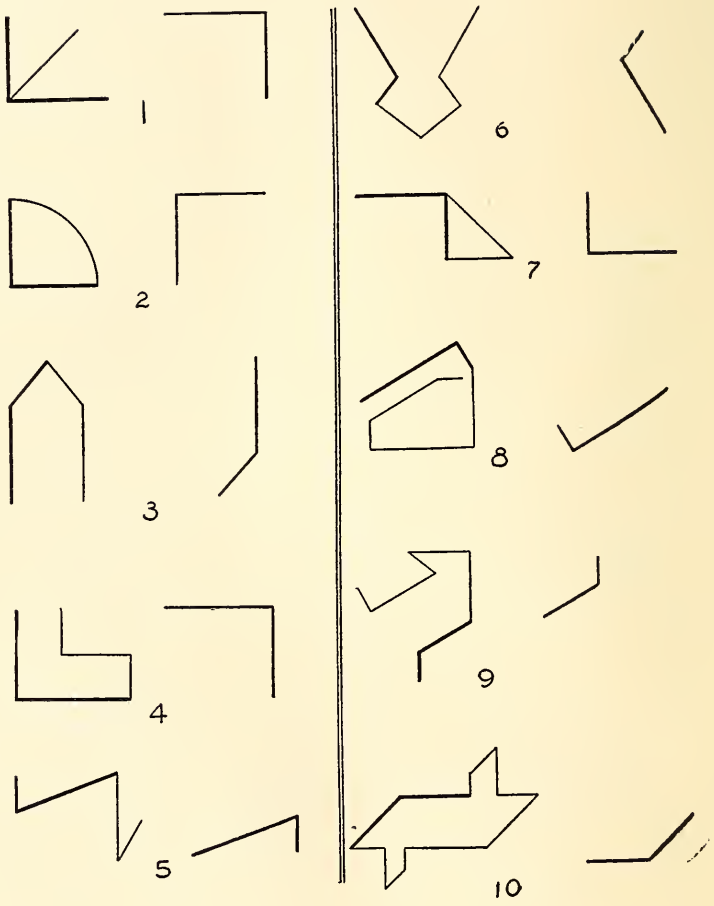


TEST 3

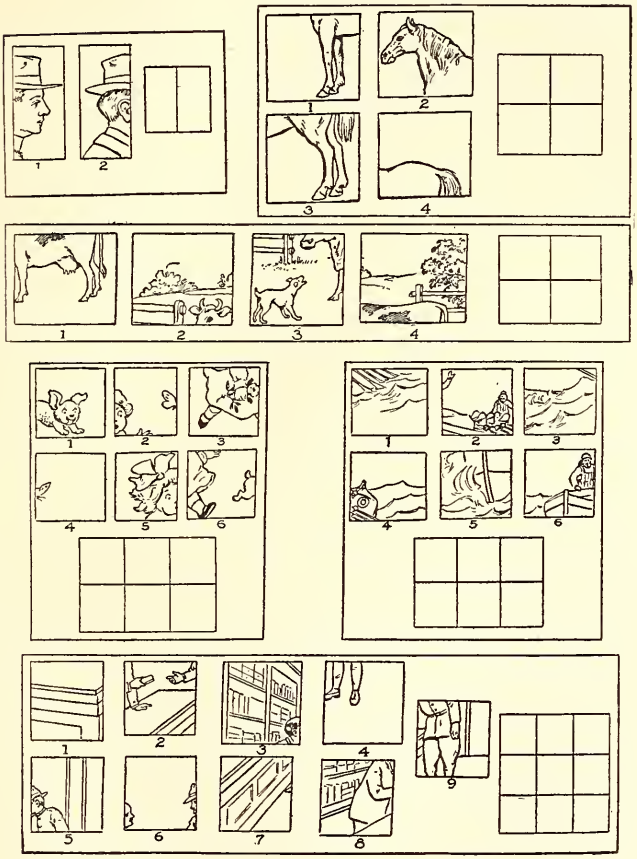


TEST 4

TEST 5



TEST 6



EDUCATIONAL SURVEY TESTS

TEST 1

Look at the words below and write

The letter F under every word that means a Flower;
The letter N under every word that means a Boy's Name;
The letter B under every word that means a Book;
The letter G under every word that means good to be or do.

samuel, kind, lily, pansy, generous, modest, claude, courteous, merciful, reasonable, isaiah, chrysanthemum, considerate, reuben, ezra, ichabod, ledger, crocus, dahlia, jonquil, begonia, equitable.

TEST 2

3×7=	Add 2 4 3	Subtract 13 8	Multiply 310 4
1)1	Subtract 50 25	Add 43 1 2 13	¼ of 128 =
Subtract 567482 106493	Add 199 194 295 156	⅞×¾=	.003) .0936

If you buy 2 pencils for 7 cents each and a book for 65 cents. How much change should you receive from a two dollar bill?

Two girls receive $2.10 for making buttonholes. One makes 42 and the other 28. How shall they divide the money,

1/3+1/3 =

7.3—3.00081=

25.09+100.4+25+98.28+19.3614=

9)69 lbs. 9 oz.

TEST 3

Answer these questions:

No. 1

The air near the ceiling of a room is warm, while that on the floor is cold. Two boys are in the room, James on the floor and Harry on a box eight feet high. Which boy has the warmer place?.....

No. 2

Think of the thickness of the peelings of apples and oranges. Put a line around the name of the fruit having the thinner peeling.

apples oranges

No. 3

If you would rather have a dollar than a little stone, do not put a line under dollar, but if you would rather have five dollars than a pencil, put a line under stone.

dollar stone

No. 4

Here are some names of things. Put a line around the name of the one which is most nearly round in every way like a ball

saucer teacup orange pear arm

No. 5

I have five plums and Mary has four plums. Jane comes along and we see that she hasn't any. We want to divide with Jane in such a way that we shall all three have the same number. I give Jane two plums. How many must Mary give her?.....

No. 6

Read these carefully:

Bears are larger than bugs.
Houses are larger than bears.
Mountains are larger than houses
Then bugs are not as large as mountains.

I have tried to make no false statement among these four. If I have succeeded, underline the word success. If I have failed, underline the word failure.

success failure

No. 7

It was a quiet, snowy day. The train was late. The ladies' waiting room was dark, smoky and close, and the dozen women, old and young, who sat waiting impatiently, all looked cross, low spirited or stupid.

In this scene, the women probably kept their wraps on, because they wished to be ready to take the train. Pretty soon the station agent came and put more coal in the stove, which was already red-hot in spots. Do you think this made the women happier? .....

No. 8

"Magnanimity in politics is not seldom the truest wisdom; and a great empire and little minds go together." (Burke)

Study Burke's quotation carefully. If he was in favor of territorial expansion as the goal of English politicians he was a standpatter. If he believed in the establishment of justice in human relations even at the sacrifice of territorial expansion, he was a progressive. Which was he, a standpatter or a progressive?..... .....

TEST 4

Read this and then write the answers. Read it again as often as you need to.

John had two brothers who were both tall. Their names were Will and Fred. John's sister, who was short was named Mary. John liked Fred better than either of the others. All of these children except Will had red hair. He had brown hair.

1. Was John's sister tall or short? .....
2. How many brothers had John?.....
3. What was his sister's name?.....

Read this and then write the answers. Read it again as often as you need to.

Long after the sun had set, Tom was still waiting for Jim and Dick to come. "If they do not come before nine o'clock," he said to himself, "I will go on to Boston alone." At half past eight they came bringing two other boys with them. Tom was very glad to see them and gave each of them one of the apples he had kept. They ate these and he ate one too. Then all went on down the road.

1. When did Jim and Dick come? .....
2. What did they do after eating the apples?.....
   .....
3. Who else came besides Jim and Dick?.....
4. How long did Tom say he would wait for them?.....
   .....
5. What happened after the boys ate the apples?.....
   .....

Read this and then write the answers. Read it again as often as you need to.

It may seem at first thought that every boy and girl who goes to school ought to do all the work that the teacher wishes done. But sometimes other duties prevent even the best boy or girl from doing so. If a boy's or girl's father died and he had to work afternoons and evenings to earn money to help his mother, such might be the case. A good girl might let her lessons go undone in order to help her mother by taking care of the baby.

1. What is it that might seem at first thought to be true, but really is false?.....
   .....
2. What might be the effect of his father's death upon the way a boy spent his time?
   .....
3. Who is mentioned in the paragraph as the person who desires to have all lessons completely done? .....

TEST 5

Make good sentences. Write only *one* word on each blank.

1. We are going.....school.
2. The sky.....blue.
3. The.....plays.....her dolls all day.
4. Boys and.....soon become.....and women.
5. The poor baby.....as if it were.....sick.
6. She.....if she will.
7. The poor little.....has.....nothing to.....;he is hungry.
8. A home is.....merely a place.....one.....live comfortably.
9. To.....many things.....ever finishing any of them.....a.....habit.
10. The knowledge of..... .....use fire is.....of.....important things known by.....but unknown.....animals.
11. One ought to.....great care to.....the right.....of....., for one who.....bad habits.....it.....to get away from them.

TEST 6

Punctuate correctly:

1. We visited New York the largest city in America.
2. I like to work he said especially in the morning.

Cross out what is wrong, and leave the words so as to make a good sentence.

1. The paper reported (he; him) to be dead.
2. I can do it as well as (they; them).
3. The difference between summer and winter (is that; is) summer is warm and winter is cold.
4. I shall always remember the town because of (the good times I had; the good time) and the many friends I made there.
5. (Who; whom) do you mean?
6. A different set of knives and forks (was; were) put on the table.
7. (He sprang; springing) to the platform on which the dead man lay (and shouted; he shouted).

TEST 7

Answer these questions:

1. In what direction are you facing when your back is toward the north?.....
2. Name two other countries in North America besides the United States.....
   .....
3. Name two large bodies of water that border on Florida.....
4. What is the cause of day and night?.....
5. Name a mountain range and a river between Europe and Asia.....
6. Give two reasons why cities usually grow up at falls in rivers.....
7. What and where are the following:
   Nova Scotia .....
   Calcutta .....
   Good Hope .....
   St. Elias .....
   Moscow .....
8. Give one reason why Chicago rather than St. Louis has become the railroad center of the middle west. .....
9. Why does the southeast coast of Brazil get a comparatively heavy rainfall?
   .....
10. Why does the temperature often rise when snow begins to fall?.....
    .....

TEST 8

Answer these questions:

1. In what did the American Indians live?
2. Who was the first President of the United States?
3. Name any American general.
4. Who was President of the United States during the Civil War?
5. Name any one of the battltes of the Revolutionary War.
6. Name two purchases of land that have been made by the United States.
7. What were the first four nations to make settlements in America?
8. What public improvement was under construction during each of the following periods:
   1806-1814 .....
   1817-1825 .....
   1904-1914 .....
9. a. Who invented the telegraph?.....
   b. Who invented the telephone? .....
   c. Who laid the first successful Atlantic cable? .....
   d. Who wrote the Declaration of Independence? .....
10. In front of each of these questions below write the name of the President during whose administration the events took place.
    .....War with Mexico?
    .....Spanish American War?
    .....Purchase of Florida?
    .....Assertion of the Monroe Doctrine in the Venezuelan dispute?
    .....Beginning of construction of Panama Canal?

CHAPTER IV

Standardization of Tests

The data collected for this study includes tests made in twenty-six deaf schools. Fifteen of these were state institutions for the deaf and the other eleven were public day schools under a public school system. The states represented were Michigan, Wisconsin, Ohio, Maryland, New Jersey, New York, Massachusetts, Connecticut, and Pennsylvania. All the testing was carried out by the writer with the exception of the tests made in the Ohio School. In this one instance the tests were given by the students in a mental test class at the Ohio State University.

After the individual sheets were graded and the total scores transferred to a card, these cards were arranged in rank order according to the total scores. Distribution tables were made for both the Non-language and the Educational Survey Tests.

Tables 1 and 2 are condensed distributions of the actual number of cases at each chronological age, making given scores. Each table has twenty-four steps. In the Mental test each step includes thirty points. In the Educational test each step includes six points. The total number of cases in each step is given in the last column of each table. A total of 2172 cases was used in the standardization.

Tables 3 and 4 give the same distributions converted into percentages. From these tables it is to be noticed that the Non-language Survey gives fairly normal distributions for each age from age eight to twenty-one plus (which includes all cases aged twenty-one and above). The Educational Survey does not show such a good distribution for ages eight and nine and is very irregular for ages nineteen, twenty and twenty-one plus.

These distributions can be observed more easily from Graphs I and II. In both graphs the same steps have been used as in the frequency tables. The limits for each step have not been fully indicated on the graph owing to the size of the reproduction.

TABLE 1
Distribution of Total Number of Cases
on Non-language Test

Age	8	9	10	11	12	13	14	15	16	17	18	19	20	21+	Total
Score															
0- 29				1		1	3		1	1					7
30- 59	2		1	2	3		3	1	1	1				1	15
60- 89	1		1	3	3	5	4	4	1	1	2	1		2	28
90-119	1	4	6	9	4	2	5	2	4	3		2			42
120-149	3	5	7	5	8	9	6	10	4		4	4		1	66
150-179	3	9	9	10	10	7	11	8	6	1	4	2	1		81
180-209	4	10	9	13	20	13	15	11	10	5	5	5	1	1	122
210-239	3	11	11	15	24	28	26	23	14	11	4	3	1	2	176
240-269	3	8	12	18	24	25	25	27	5	8	5	2	1	1	164
270-299	2	3	13	16	19	35	31	29	15	15	8	4	6	2	198
300-329		7	19	24	32	27	29	31	21	11	7	5	4	8	225
330-359		5	2	17	24	23	39	32	20	13	6	8	3	3	195
360-389			4	9	18	26	36	37	36	19	11	11	4	2	213
390-419			1	4	18	22	27	35	27	15	13	7	2	10	181
420-449				4	5	17	27	24	22	19	7	8	4	10	147
450-479		1		1	3	12	11	18	18	17	18	8	8	15	130
480-509					4	5	8	11	15	16	6	7	5	7	84
510-539			1			2	4	5	4	13	8	11	6	8	62
540-569						1	3	4	2	1	3	2	3	6	25
570-599									1	1	1	1	3	3	10
600-629													1		1
630-659															
660-689															
690-700															
Total	22	63	96	151	219	260	313	312	227	171	112	91	53	82	2172

TABLE 2
Distribution of Total Number of Cases
on Educational Test

Age	8	9	10	11	12	13	14	15	16	17	18	19	20	21+	Total
Score															
0- 5	15	27	35	32	32	24	23	11	8	4		1		3	215
6- 11	4	21	32	46	45	40	29	33	13	9	4	8		2	286
12- 17	1	7	17	40	49	52	42	40	26	5	10	5		5	299
18- 23		4	5	20	35	42	61	41	31	18	7	6	2	3	275
24- 29		1	3	6	22	36	56	49	29	32	15	6	1	6	262
30- 35	2		3	4	18	19	41	43	35	25	19	6	10	1	226
36- 41		1		1	7	13	17	27	18	17	9	9	6	2	127
42- 47		1		1	3	8	11	17	17	10	6	13	4	3	94
48- 53		1			4	3	12	8	14	13	9	10	3	3	80
54- 59					1	8	7	12	8	8	7	6		4	61
60- 65				1	1	4	5	11	7	8	5	4		5	51
66- 71			1			3	6	7	8	5	7	3	5	7	52
72- 77						6	3	6	3	5	6	4	1	8	42
78- 83					1	1			3	4	2	3	6	5	25
84- 89					1	1		6	3	1	2		6	5	25
90- 95								1	3	3	2	3	5	9	26
96-101										3	2	3	1	4	13
102-107									1			1	3	3	8
108-113														3	3
114-119										1					1
120-125														1	1
126-132															
133-138															
139-141															
Total	22	63	96	151	219	260	313	312	227	171	112	91	53	82	2172

TABLE 3

Percentage Distribution for Each Age on the Non-language Test

Age	8	9	10	11	12	13	14	15	16	17	18	19	20	21+	Total
Score															
0- 29				0.7		0.4	1.0		0.4	0.6					0.30
30- 59	9.1		1.0	1.3	1.5		1.0	0.3	0.4	0.6				1.2	0.69
60- 89	4.5		1.0	2.0	1.5	1.9	1.3	1.3	0.4	0.6	1.8	1.1		2.4	1.29
90-119	4.5	6.4	6.3	5.9	1.8	0.8	1.6	0.6	1.8	1.8		2.2			1.93
120-149	13.6	7.9	7.3	3.3	2.7	3.5	1.9	3.2	1.8		3.6	4.4		1.2	3.03
150-179	13.6	14.3	9.4	6.6	4.7	2.7	3.5	2.6	2.6	0.6	3.6	2.2	1.9		3.72
180-209	18.2	15.9	9.4	8.6	9.2	5.0	4.8	3.5	4.4	2.9	4.5	5.5	1.9	1.2	5.61
210-239	13.6	17.5	11.5	9.9	10.9	10.8	8.3	7.4	6.2	6.4	3.6	3.3	1.9	2.4	8.10
240-269	13.6	12.7	12.5	11.9	10.9	9.6	8.0	8.7	2.2	4.7	4.5	2.2	1.9	1.2	7.55
270-299	9.1	4.8	13.5	10.6	8.7	13.4	9.9	9.3	6.6	8.8	7.1	4.4	11.3	2.4	9.11
300-329		11.1	19.8	15.9	14.6	10.4	9.3	9.9	9.2	6.4	6.2	5.5	7.5	9.8	10.35
330-359		7.9	2.1	11.3	10.9	8.8	12.4	10.2	8.8	7.6	5.3	8.8	5.6	3.7	8.97
360-389			4.2	5.9	8.4	10.0	11.5	11.8	15.8	11.1	9.8	12.1	7.5	2.4	9.80
390-419			1.0	2.6	8.4	8.5	8.6	11.2	11.9	8.8	11.6	7.7	3.8	12.2	8.33
420-449				2.6	2.4	6.5	8.6	7.7	9.7	11.1	6.2	8.8	7.5	12.2	6.76
450-479		1.6		0.7	1.5	4.6	3.5	5.8	7.9	10.0	15.9	8.8	15.1	18.3	5.98
480-509					1.8	1.9	2.6	3.5	6.6	9.4	5.3	7.7	9.4	8.5	3.86
510-539			1.0			0.8	1.3	1.6	1.8	7.6	7.2	12.1	11.3	9.8	2.85
540-569						0.4	1.0	1.3	0.9	0.6	2.7	2.2	5.6	7.3	1.15
570-599									0.4	0.6	0.9	1.1	5.6	3.7	.46
600-629													1.9		.04
Total	99.8	100.1	100.0	99.8	99.9	100.0	100.1	99.9	99.8	100.2	99.8	100.1	99.7	99.9	99.88

TABLE 4
Percentage Distribution for each Age on the Educational Test

Age	8	9	10	11	12	13	14	15	16	17	18	19	20	21+	Total
Score															
0- 5	68.1	42.8	36.5	21.2	14.6	9.2	7.3	3.5	3.4	2.3		1.1		3.7	9.89
6- 11	18.2	33.3	33.3	30.4	20.5	15.4	9.3	10.6	5.5	5.3	3.6	8.8		2.4	13.16
12- 17	4.5	11.1	17.7	26.4	22.4	20.0	13.4	12.8	11.3	2.9	8.9	5.5		6.1	13.76
18- 23		6.3	5.2	13.2	16.0	16.2	19.5	13.1	13.5	10.5	6.2	6.6	3.8	3.7	12.06
24- 29		1.6	3.1	4.0	10.0	13.8	17.9	15.7	12.5	18.7	13.4	6.6	1.9	7.3	10.40
30- 35	9.1		3.1	2.6	8.2	7.3	13.1	13.8	18.2	14.6	16.9	6.6	18.8	1.2	5.84
36- 41		1.6		0.7	3.2	5.0	5.4	8.6	7.7	9.9	8.0	9.9	11.3	2.4	4.32
42- 47		1.6		0.7	1.4	3.1	3.5	5.4	7.3	5.9	5.4	14.3	7.5	3.7	3.68
48- 53		1.6			1.8	1.2	3.8	2.6	6.1	7.6	8.0	11.0	5.7	3.7	2.80
54- 59					0.5	3.1	2.2	3.8	3.4	4.7	6.3	6.6		4.9	2.34
60- 65				0.7	0.5	1.5	1.6	3.5	3.0	4.7	4.5	4.4		6.1	2.39
66- 71			1.0			1.2	1.9	2.2	3.4	2.9	6.3	3.3	9.4	8.5	1.93
72- 77						2.3	1.0	1.9	1.2	2.9	5.4	4.4	1.9	9.8	1.15
78- 83					0.5	0.4			1.2	2.3	1.8	3.3	11.3	6.6	1.15
84- 89					0.5	0.4		1.9	1.2	0.6	1.8		11.3	6.1	1.19
90- 95								0.3	1.2	1.8	1.8	3.3	9.4	10.9	.59
96-101										1.8	1.8	3.3	1.9	4.9	.36
102-107									0.2			1.1	5.7	3.7	.13
108-113														3.7	.04
114-119										0.6				1.2	.04
120-125															
126-131															
132-137															
138-141															
Total	99.9	99.9	99.9	99.9	100.1	100.1	99.9	99.7	100.3	100.0	100.1	100.1	99.9	100.6	99.88

Only the first limiting point of each step is indicated. Thus on Graph I the first step is marked 0, meaning a step from 0 to 29; the next is marked 30, meaning a step from 30 to 59; and so forth. On Graph II the first step is marked 0, meaning a step from 0 to 5; the next step is marked 6, meaning a step from 6 to 11; and so forth.

Graph I is a picture of the Mental Survey percentage distribution at each age, showing for the most part fairly regular curves. The dotted lines mark the median scores for each age. These medians increase from age to age, with the exception of ages nineteen and twenty-one, indicating that our tests differentiate between children of varying ages.

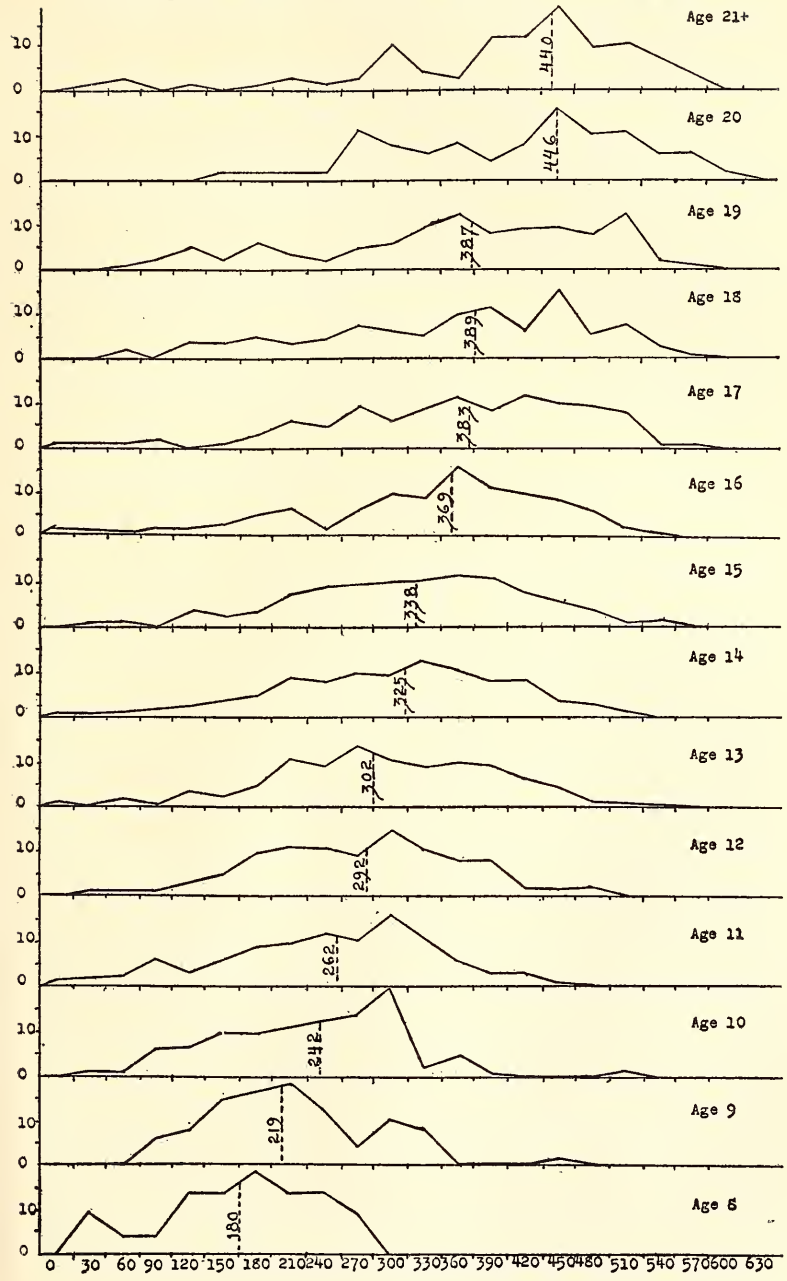
The differences in the medians after age sixteen become very small, as we should expect to be the case, knowing, as we do, that little, if any, growth of intelligence is to be expected beyond that age. There is a decided jump in the median between ages nineteen and twenty. The increase here is in all probability due to the selected group of cases above age nineteen, including, as it does, many of the college students at Gallaudet College.

Graph II shows the percentage distribution at each age for the Educational Survey Tests. These curves are markedly different from the curves on Graph I. The much greater steepness of the curves for the lower ages is striking. Indeed for ages eight, nine and ten the curves are really only partial curves. This shows that the Educational Test is too difficult for the poorer forty to sixty percent of children at ages eight, nine, and ten and also for the lowest fifteen to twenty percent at ages eleven and twelve. It does not mean that these children were not able to do anything but rather that it was too small an amount to differentiate them adequately. The steepness of the right half of these curves for the lower ages means that there is a differentiation of the brighter groups of children at each of these ages into relatively large groups but that the test does not furnish a very fine differentiation.

The curves for the ages above eleven become more regular until we arrive at age nineteen. The curves for ages nineteen, twenty and twenty-one plus are extremely irregular, indicating

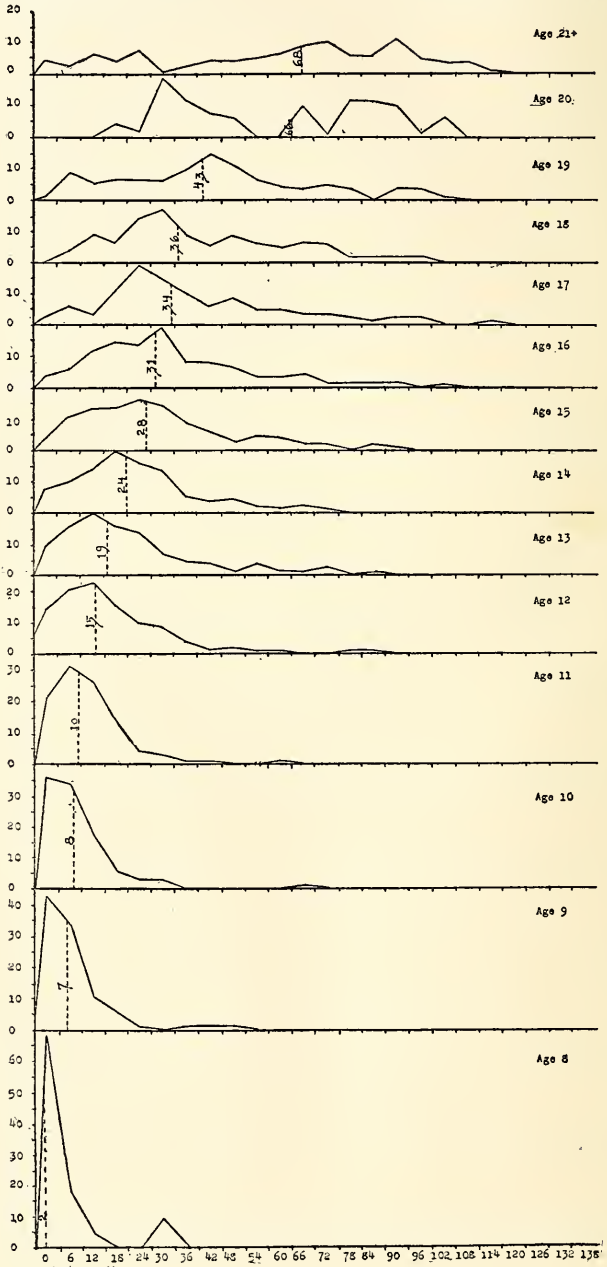
GRAPH I

Percentage Distribution for Each Age on the Non-language Test



GRAPH II

Percentage Distribution for Each Age on the Education Test



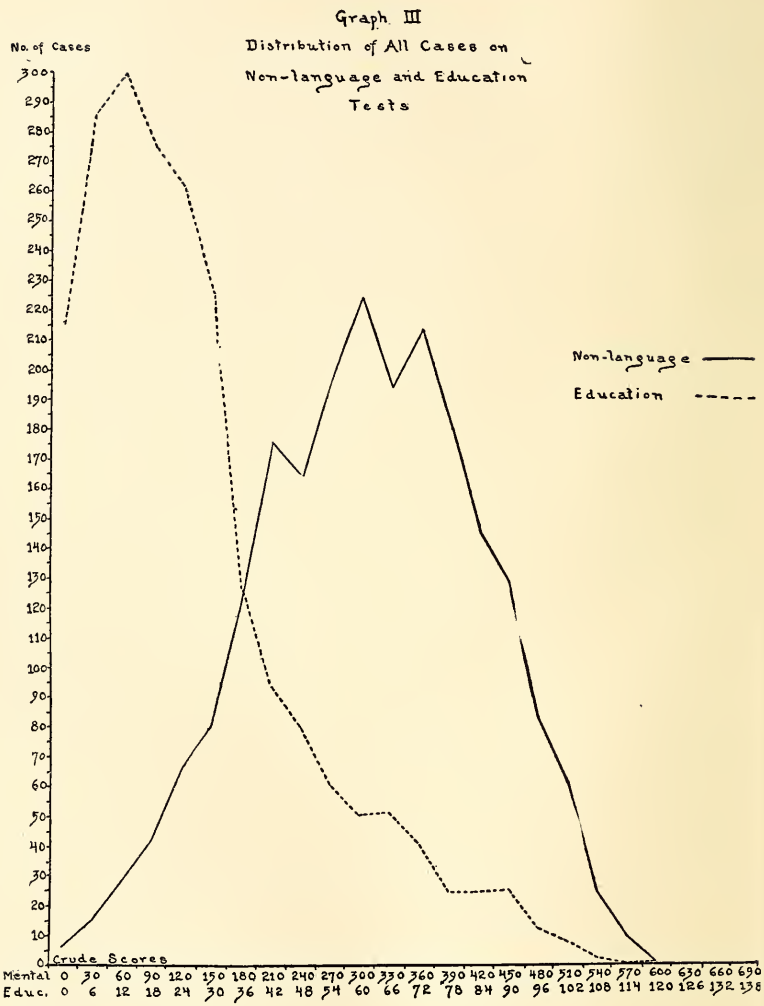
the heterogeneity in regard to educational attainment of the cases at these ages. Ages twenty and twenty-one plus indicate almost two distinct groups and these are indeed present, namely the better educated college students on the one hand and on the other, the older children who are still permitted to remain in the ordinary schools.

The dotted line in this graph again denotes the median score for each group. The increase in this median score from age to age is very uniform. It shows that the educational test is difficult enough to measure the attainments of deaf children at any age with reference to the ordinary subjects of the school curriculum. The fact that no curve comes anywhere near the maximum score indicates that the test offers plenty of scope for measuring a much higher degree of educational attainment than is ever achieved.

Graph III shows the frequency distribution for all ages and is constructed from the "Total" columns of Tables 1 and 2. The solid line curve indicates the distribution of the Non-language Test. The dotted line indicates the distribution of all ages on the Educational Test. The Non-language curve shows a remarkably normal distribution. The Educational curve, although considerably more pointed, exhibits at least half of a normal curve. The preceding age graphs show exactly at what age children fall into the undifferentiated group at the left side of the educational curve.

These two curves show the distribution according to the crude scores on both tests, that is, the mental curve is a measure of the actual mental ability of all the cases regardless of age, and similarly with the educational curve. They are not to be considered in any sense diagnostic curves. We cannot deduce from them the percentage of feeble-minded or very superior children. What the curves really give us is some sort of measure of the value of our measuring instruments.

The mental curve shows that only seven cases scored between 0 and 29 points. This means that there are only seven out of 2172 cases that may possibly be inadequately measured mentally in the sense that our scale at this end is not fine enough to dif-



ferentiate between the degree of intelligence at this lower end. At the upper end there are three steps not rperesented by any cases, so that our scale is difficult enough to measure all degrees of brightness. Taken as a whole, therefore we conclude that the mental test gives plenty of scope to measure all degrees of intelligence in deaf children above age eight.

A similar scrutiny of the educational curve reveals at once its defect. This lies in the fact that it gives no adequate measure of the educational attainment of 215 out of 2172 cases. We do not really have an educational differentiation of these 215 cases. Our scale is not easy enough for them. All that it does is to group them together and indicate that they are below a certain standard of educational attainment. Theoretically, therefore, there is room for a still simpler form of educational test for deaf children. Practically, however, the differentiation given by our scale has been found to be sufficient for grades three and above in the average deaf school.

PERCENTILES.

The percentiles were obtained directely from the cards arranged in rank order for each age. One tenth of the total number of cases at any one age was obtained from the large distribution charts. That is, if there were 450 cases at age nine, one tenth or ten per cent would be 45, therefore, the score of the forty-fifth card would be the tenth percentile. One twentieth of the 450 cards or the ninetieth card would give the twenty percentile, and so on, adding ten percent each time. The lowest score for each age has been called the zero percentile. In the percentile tables given in Chapter V every fifth percentile is shown. The first and the ninety-ninth percentiles have also been calculated in order to secure greater accuracy at the upper and lower ends of the distribution where the differences in score are naturally the greatest. Finer interpolations must be made between these given percentiles.

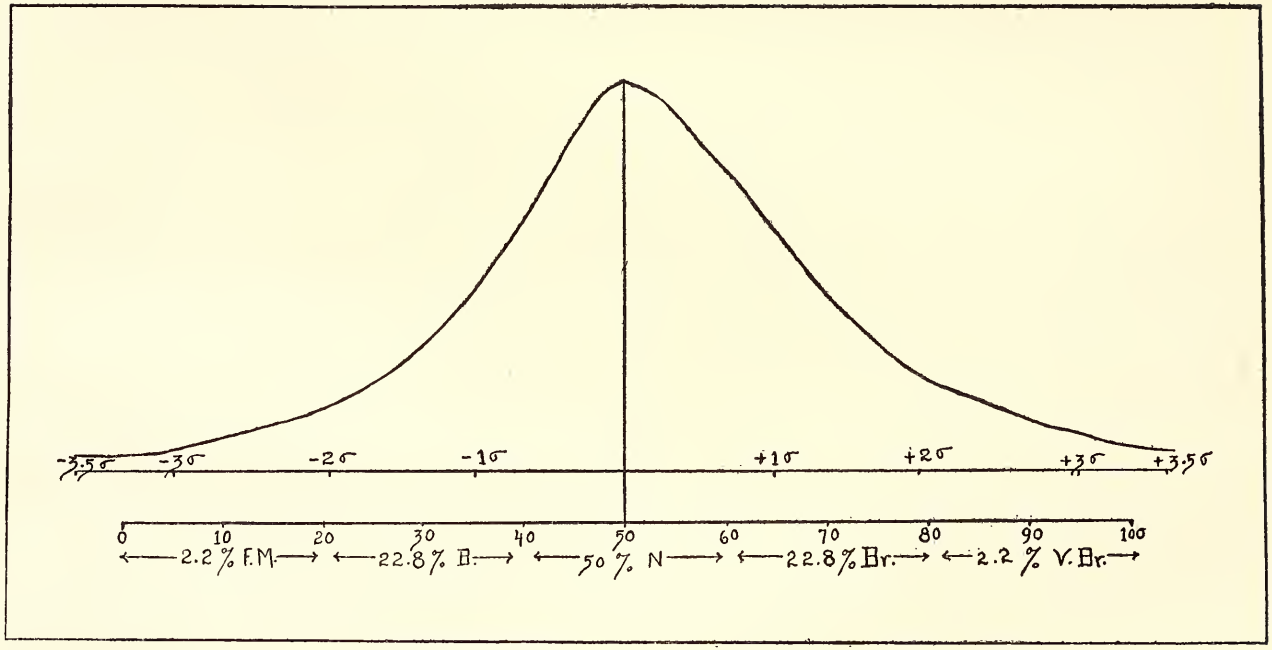
THE INDEX

In order to be able to state the difference between a child's performance on the educational and his performance on the mental tests, some other value in addition to his percentile rank must be obtained. The percentile standing cannot be used for this purpose, because of the fact that a given difference between percentiles at the upper and lower ends of the distributions denotes a much greater difference in amount than does the same difference between percentiles in the middle of the distribution. For this

reason percentile ranks must be converted into standard deviations. These standard deviations or sigma values give us an absolute measure of any child's performance. The differences between any two standard deviations are comparable, regardless of their position in the distribution curve. We have used the portion of the normal curve lying between plus 3.375 sigma and minus 3.375 sigma and have divided this into five equal parts, so that we might have 50 percent in the middle group; 22.8 percent in the next two groups; and 2.2 per cent in the upper and lower groups.

The scale of standard deviation values from plus 3.375 sigma to minus 3.375 sigma might, of course, have been used as our index. The use of such values, having positive and negative signs and running into two and three decimal places, would be rather cumberous and undoubtedly very terrifying to the ordinary teacher who might use our tests and who cannot be expected to appreciate the significance of standard deviation values. For this reason we have converted our scale which runs from plus 3.375 sigma to minus 3.375 sigma into a scale running from 100 to 0, each step on such a scale being, of course, equal to every other. These values from 0 to 100 we have designated indices. To convert percentiles into indices it is merely necessary to read them from Table 9 (page 59). A division of these index values given on Graph IV into five groups corresponds to the five equal groups formed by our sigma values. Fifty percent of the total number of cases fall between the indices 40 and 59. This may be called the average or normal group. The next lower group, comprising 22.8 percent of the total number, includes indices from 20 to 39. This group is designated backward. The lowest 2.2 percent of the cases show indices from 0 to 19 and may be considered the dull or feeble-minded group. The 22.8 percent of cases just above the average or middle group, have indices from 60 to 79. This group should be called bright or superior. The highest 2.2 percent of cases include indices from 80 to 100. These are the very bright or very superior children.

GRAPH IV
Normal Distribution Curve



Indices	Description of Mental Test	Type of Performance on Educational Test
0 to 19	Dull	Very Poor
20 to 39	Backward	Poor
40 to 59	Normal	Average
60 to 79	Bright	Good
80 to 100	Very Bright	Very Good

The advantage of such an index is that it can be used for both series of tests; that is, after the crude scores have been converted into percentiles, the conversion into an index gives us an absolute measure of the child's standing. Because the significance of the index is the same for both series of tests, we can subtract the one from the other and have a single figure which represents the relation between the educational and the mental ratings of the child. If the educational index be subtracted from the mental index the average child, that is, the one doing educational work which matches his native ability will show a zero or very small difference. The differences in the group considered normal or average are from plus 10 to minus 10.

This Difference is an important diagnostic value. It is to obtain such a Difference that the indices have been used. Our standardization of both tests has been restricted to those cases that have taken both tests in order to be able to arrive at this Difference and to give it diagnostic significance. This Difference expresses the relationship between the child's mental ability and his educational attainment regardless of his actual ability or attainment. If children of any degree of mental ability are doing educationally what is ordinarily accomplished by such degrees of mental ability they will all have a Difference approximating zero. Those Differences clustering around zero, say from minus 10 to plus 10, indicate that mental ability and educational attainment are in harmony, that they are well balanced, that accomplishment is worthy of the native ability possessed by the child—even although that ability be very great, medium or very poor. In the same way large plus Differences are diagnostic of greater educational achievement than is ordinarily found with the given ability in question. Large minus Differences are indicative of wasted ability; they denote children who have more mental ability than they are making use of in their scholastic work.

The standardization and method of evaluation of our tests gives us, therefore, three important values:

1. The Mental Index, being a measure of the degree of intelligence possessed by the child.
2. The Educational Index, being a measure of the degree of educational accomplishment attained by the child with reference to children of his own age.
3. The Difference, being a measure of the relationship between mental ability and educational accomplishment.

Reliability Coefficients.

In one school where the Survey had been given, the request was made for a second Survey, again using both the Non-language and Educational Survey Tests. This furnished an unexpected means of proving the reliability of our test series of which we were glad to avail ourselves.

The first mental survey was made in May 1918 and the second in January 1920. Twenty months or not quite two years elapsing between the two tests. The first educational survey was made in January 1919 and the second just exactly one year later, in January 1920. The second survey in both instances was made by Miss Hazel Knight of the Ohio State University, and we are indebted to her for the results.

Since the school tested was one of the larger institutions, the writer was able to find 215 children who had taken the Non-language test on both dates and 246 children who had taken the educational test twice. Both these groups were large enough to furnish very reliable correlations between the two testings.

The correlations for both the Mental and Educational Surveys are shown in Tables 5 and 6.

The mental test correlation gives a coefficient of .726 while the educational test gives a coefficient of .76. Both these figures were beyond the expectations of the writer and prove the reliability of the Survey Tests to a marked degree. The slightly higher correlation on the educational test may be due to the fact that the time that elapsed between the two educational tests was considerably shorter than the interval between the mental tests.

TABLE 5

Correlation Table for Tests made in 1918 and 1920 on the Non-language Scale

(1920)	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-100	F.
90-100						1	1	1			3
80- 89					1		1	1			3
70- 79				1	1	3	6	4			15
60- 69				3	7	11	15	1	1		38
50- 59			2	11	15	11	3	1			43
40- 49			9	23	27	11	1				71
30- 39	1	4	7	14	1		1				28
20- 29	1	1	4	3							9
10- 19	2	3									5
0- 9											
(1918) F.	0-9 4	10-19 8	20-29 22	30-39 55	40-49 52	50-59 37	60-69 28	70-79 8	80-89 1	90-100	

TABLE 6

Correlation Table for Tests made in 1918 and 1920 on the Educational Scale

(1920)	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-100	F.
90-100									1		1
80- 89											
70- 79						1	4	2	1		8
60- 69					4	17	21	2			44
50- 59				6	11	41	16	1			75
40- 49				9	35	17	1				62
30- 39	1		9	15	17	1	1				44
20- 29	1		6	3							10
10- 19			1	1							2
0- 9											
(1918) F.	0-9 2	10-19	20-29 16	30-39 34	40-49 67	50-59 77	60-69 43	70-79 5	80-89 2	90-100	

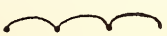
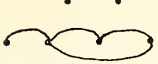
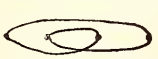
CHAPTER V

Directions for Giving the Survey Tests

The tests can be given to groups of children.* The groups may be of any size that is convenient to handle. As many as fifty or sixty have been tested at the same time. Least confusion arises if the testing is carried out with classes as they are found, but, in order to save time, two classes may sometimes be combined.

After the pupils are seated comfortably and not too near each other, pass the Non-language booklets. Have subjects fill out the blanks on the first page with full name, grade, age, and other data if desired. If necessary use the signs for "name" and "age." Do not allow the pages to be turned until the children are told to do so. Attract the attention of the subjects by tapping on the floor in order to secure uniform attention throughout the class. Tell children to put their pencils down after filling out first page. Then call their attention to the blackboard.

Test 1—Imitation.

No time limit. Draw four large dots on the blackboard about twelve inches apart. Below or to one side draw three rows of four smaller dots each, to be used as samples. Then have them turn over the page to Test 1 where the dots are arranged in rows. Be sure to have full attention of every child. With a pointer trace a line from one dot to the other, pausing a moment on each dot, at the rate of about one a second. The first line is in the order 1, 2, 3, 4, starting at the left-hand side. The examiner should draw the line from dot to dot for the first sample thus:  The second and third samples are 12342  and 14321  . Always use the same samples. Be careful to stand so that all children can see clearly. Children can be called to the board to draw the last two

* Test blanks, manual of directions and stencils for scoring published by The College Bookstore, Columbus, Ohio.

samples. After the examiner is sure the children understand what is required, have them take up their pencils. Erase the three samples and proceed with the lines:

1. 12341	5. 123431	9. 13242
2. 1432	6. 1342	10. 12431
3. 1423	7. 13241	11. 134212
4. 14321	8. 123421	12. 124314

It is well to memorize these lines even though you have them on paper in your hand. Do not give the children any indication that the dots are numbered. Allow sufficient time between each blackboard tracing for the children to draw the lines on their papers. Do not repeat any line. Where possible, see that the children draw on the line corresponding with the number of the line given. No talking is necessary and only natural gestures are used. Pencils down—Attention.

Test 2—Easy Learning.

Time limit one minute.

Draw the same three squares on the blackboard as given at the top of the page and five squares with signs only in them. Have the children turn over the page. Explain by gestures that a certain sign (—) belongs with number one, another (X) belongs with number two, and so on. Then have several different children come to the board to fill in the sample. Erase the sample on the board, hold an open page before the class and indicate that they are to put the proper numbers in the squares. Attract their attention and make the sign for them to begin work. Use a stop-watch or an ordinary watch with a second hand. When the time limit is up, stop them promptly by tapping on the floor. Pencils down—Attention.

Test 3—Hard Learning.

Time limit one and one half minutes.

During the preceding test the nine squares for this page should be copied on the board and a sample given. Turn over the page to the next test. Proceed as in Test 2. With older children the blackboard demonstration is unnecessary since Test 2 serves as sufficient explanation.

Test 4—Drawing Completion.

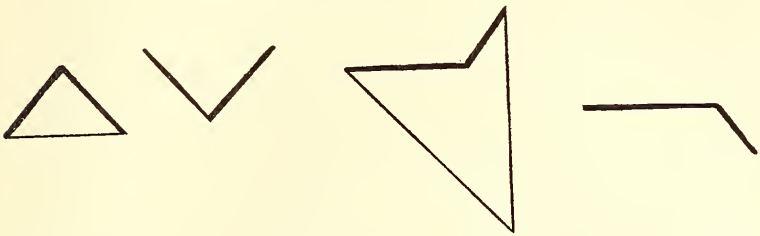
Time limit two minutes.

Draw head, with one eye left out, on the board. Indicate by gestures that something is missing and ask what is wrong. Have pupil come to the board to draw the eye. Hold sheet before the class and show them how to turn it around. Then indicate that they are to complete the remaining pictures.

Test 5—Reversed Drawings.

Time limit four minutes.

While the children are working on Test 4 draw on the board the following samples, accentuating the heavy and fine lines:



Turn over the page. Trace with the finger the heavy lines on the first or complete figure and then the similar lines on the second figure. Cover the first figure with the opened left hand, palm toward the board. Turn the hand slowly over, at the same time bringing it to cover the second figure, showing by the motion that the figure has been reversed. Repeat this movement once or twice. Now trace the first heavy line with the finger and show where it is on the second figure; then trace the second heavy line and show where it goes on the second figure. Then trace the fine line and ask where it should go. Call a child to the board and allow him to draw the line in the proper place. Indicate your approval by a smile or clapping the hands. Proceed with a similar demonstration of the next sample, calling another child to the board for the completion of the second drawing. Repeat the turning-over movement of the hand several times after the completion of the drawing to impress the fact that the second drawing is upside-down.

Test 6—Picture Reconstruction.

Time limit five minutes.

For this demonstration a sample picture, cut in half is needed. The writer uses an India ink drawing of a little girl on two pieces of white cardboard, each measuring about 6x17 inches. These pieces are numbered so that when put together correctly the numbers read 2-1, that is, when facing the picture, the left-hand piece is number 2 and the right-hand piece number 1. While the children are working on Test 5 place the two parts of the picture in order 1-2 on the rail of the blackboard, that is, the two pieces of the picture will not be in the correct order. On the board draw a square divided into two parts for the numbers, as on the test blank. When the time for Test 5 has elapsed, stop the children and have them turn over the page to Test 6. Trace with finger the outline of the first part of the picture and indicate into which space it would go on the board and similarly with the second part of the picture. Then point to number 2 and write it in the first space on the board and then to number 1 and write it in the other. Pointing to the numbers and spaces may be repeated more than once. Having written in the numbers, now hold the two parts of the picture over the space on the board so as to make a complete picture and indicate that it is a complete picture; then show that the numbers in the spaces on the board correspond with the numbers at the bottom of the two parts of the picture which is now being held just above them.

It is very important to remember that this procedure in giving the test is the standard procedure, and that upon this procedure and no other, norms for the deaf have been based. Any deviation from this procedure will make the scores obtained useless for comparison with our standards. To change the method of giving is to change the test and new standards will have to be made for the new method. Any teacher of the deaf, who is giving the test, must bear this in mind. If he or she introduces more explanation, the test will be made so much easier, and, therefore, the children will do better than they would with the standard procedure. The results will not give a true measure of the ability of the children. Children who cannot follow the standard

explanation of the tests are children of inferior intelligence and are therefore penalized to that extent. They make poor scores, which are indicative of their intelligence.

If one who is not familiar with the deaf is doing the testing he can quickly learn the signs for "name," "how old," "the same," and "stop" from some teacher. These were the only signs used by the writer, since so little explanation is necessary other than the blackboard demonstration.

Collect the Mental Test papers and pass the Education Test booklets. Fill in blanks with name, age, grade, and other data if desired. Demonstrate that the booklet is to be turned around and not opened. Indicate that they are to read the explanation printed just above the test and do what it tells them to do below. Immediately thereafter give the signal to begin. Reading the instructions on each page is a part of the test and is included within the time limit of each test. Do this for each succeeding page. As in the first booklet the right-hand pages are completed, then the whole booklet turned around so that the opposite pages now fall to the right.

Allow no questions and make no further explanation other than to make the child read the explanation at the top of each page. The tests are testing the ability of the children to read the instructions as well as to answer the questions. Do not explain what "punctuate" means in Test 6, nor indeed the preliminary instructions for any of the tests.

TIME LIMITS.

Test 1. Words, 1½ minutes.
Test 2. Arithmetic, 5 minutes.
Test 3. Reading K., 2½ minutes.
Test 4. Reading T., 3½ minutes.
Test 5. Trabue, 4 minutes.
Test 6. Grammar, 1 minute.
Test 7. Geography, 4 minutes.
Test 8. History, 4 minutes.

SCORING.

Celluloid stencils are used in scoring Tests 1, 2, 3, 5, and 6 of the Non-language Survey Test. No stencil is required for Test 4. Give scores as follows:

Test 1. One point for each line absolutely correct.
Total—12 points.

Test 2. One point for each space filled in with the correct digit.
Total—50 points.

Test 3. One point for each space filled in with the correct digit.
Total—50 points.

Test 4. Two points for the right thing in the right place; one point for the right thing but in the wrong place. No credit for any additional thing that may be reasonable, if the necessary missing part has been omitted.

Picture 1 needs a leg; Picture 2 needs a handle and is correct whether up or down or horizontal; Picture 3 needs an umbrella handle, one point only if the handle is visible through the cover; Picture 4 must have a pipe, cigarette, or cigar in the hand to secure a score of two points. If the right thing is in the mouth a score of one is given. Picture 5 needs a door; Picture 6 needs a little toe; one point if the extra toe is put on the wrong side. Picture 7 needs a bow across the strings of the violin; one point if the bow is anywhere else on the picture. Picture 8 needs an ear on the elephant; one point for two ears. Picture 9 needs a chain from the ratchet wheel extending to rear wheel; one point if the chain goes to front wheel. Picture 10 needs a string on the bow held back by the right hand, if straight it is only given one point.

Total—20 points.

Test 5. One point for each reversed drawing correctly performed. No discount for poor drawing, but the direction of the lines must be correct. The last drawing must be absolutely correct in order to get credit.

Total—10 points.

Test 6. One point for each number in the proper space. Give one point credit wherever the numbers correspond with the cor-

rect numbers on the stencil, even although it may seem to be pure chance.

Total—31 points.

The crude scores from the test sheets are transferred to the proper place on a card of the following type, filled in with the name, age, and grade for each child.

The first column on the card gives the names of the eight educational tests, after each of which the score obtained is recorded. The third column gives the names of the six mental tests after which the scores obtained are written. The next column gives the weight for the mental test scores, *i.e.,* the several mental test scores must be multiplied by the appropriate numbers as printed and the weighted scores written in the space provided.

Form 1646

PSYCHOLOGICAL CLINIC, OHIO STATE UNIVERSITY
Mental and Educational Survey Tests

NAME GRADE AGE

Words	11	Imitation	12	9	108	Ed. % Grade		
Arithmetic	36	E. Learn	50	2	100	Ed. In. Grade		
Reading-K	16	H. Learn	50	2	100	Ed. In. Age		
Reading-T	11	Dr. Comp.	20	5	100	Mental In.		
Trabue	11	Rev. Dr.	10	10	100	Difference		
Grammar	9	Pict. Re.	31	3	93			
Geography	23							
History	24							
Total	141				601			
Percentile	100				100			

SCORING—Educational Survey.

A celluloid stencil can be used for the first, second and third tests and the correct answers for the other tests written on separate cards. This makes the scoring objective and allows the papers to be graded very quickly by several people, each marking one page.

Test 1. 0.5 of a point for each letter correct.
Total—11 points.

Test 2. Two points for each absolutely correct answer.
Total—36 points.

Test 3. Each correct answer receives 2 points.
Total—16 points.

Test 4. One point for each correct answer.
Total—11 points.

Test 5. One point for each correct answer.
Total—11 points.

Test 6. One point for each absolutely correct sentence.
Total—9 points.

Test 7. One point for each correct fact.
Total—23 points.

Test 8. One point for each correct fact.
Total—24 points.

These crude scores are also transferred to the above mentioned cards in their appropriate places. These scores added give a possible total of 141 points.

PERCENTILES.

The total scores for the educational survey are converted into percentiles according to Table 7. Find the chronological age corresponding with that of the child in question, following down the column to the number most nearly corresponding with the total score on the card. Interpolate when necessary. With a ruler placed horizontally read the point indicated in the column marked "percentile" on the left-hand side of the page. Put on the card for the child below the total where it says "percentile."

Do the same for the total weighted scores in the Non-language Survey from Table 8.

Record this percentile on the card below the total weighted score.

INDICES.

To convert the percentiles into indices use Table 9. Find the percentile in the column headed "percentile" and read the corresponding index in the next column.

TABLE 7

Age Percentiles for the Educational Survey Test

Percentile	Age 8	9	10	11	12	13	14
100	30	49	67.5	64.5	86	88.5	75.5
99	30	43	34	38	62	75	69
95	30	29	28	26	41	62	57
90	13	18	18	22	34	47	48
85	9	14	15	19	30	38	40
80	9	12	14	18	27	34	35
75	9	11	13	17	25	30	32
70	5	10	11	15	22	28	30
65	2	9	9	13	20	25	29
60	2	8	9	13	19	23	27
55	2	8	8	12	16	20	26
50	2	7	8	10	15	19	24
45	2	6	7	9	14	18	22
40	2	3	6	9	13	16	20
35	0	3	5	8	11	15	19
30	0	3	4	7	10	13	17
25	0	2	4	6	8	12	15
20	0	2	3	5	6	10	13
15	0	1	2	4	6	8	11
10	0	0	2	2	4	6	7
5	0	0	0	1	3	4	4
1	0	0	0	0	0	1	0
0	0	0	0	0	0	1	0

Percentile	Age 15	16	17	18	19	20	21 and over
100	90	102	115	100	102	106	121
99	87	92	100.5	97	101.5	103.5	109
95	68	75	81	81	91.5	100	105
90	59.5	63	70	73	79.5	93	99
85	49.5	55	63.5	67	69	90	95
80	44	51	57.5	64	61.5	87.5	92
75	39	45	52	56.5	58	86	89.5
70	36	40	47.5	53	53	79.5	81
65	33	37	42	48	50	79	79.5
60	31	34	40	46	49	73	74.5
55	29	32	36	40	46	68.5	72
50	28	31	34	36	43	66	68
45	25	29	32	32	41	49	64
40	23	26	29	31	38	44	60.5
35	21	24	28	30	34	41	55
30	20	21	26	29	30	38	44.5
25	17	19	25	27	27	35	37
20	14	17	22	25	20	34	25.5
15	12	15	20	21	17	33	22
10	10	12	13	14	11	31	14
5	6	6	10	12	8	28	6
1	1	2	3	8	4	18	0
0	0	2	0	8	4	18	0

TABLE 8

Age Percentiles for the Non-language Survey Test

Percentile	Age 8	9	10	11	12	13	14
100	299	452	530	466	500	552	566
99	299	354	403	434	497	502	531
95	296	347	360	392	425	468	464
90	258	322	326	364	405	437	442
85	251	315	318	353	385	411	427
80	242	294	306	334	366	398	409
75	236	267	300	323	346	385	392
70	215	262	289	315	337	367	378
65	205	248	281	306	323	349	362
60	194	231	273	297	315	335	353
55	193	227	256	288	303	318	339
50	180	219	242	262	292	302	325
45	169	208	233	257	272	291	315
40	165	204	221	241	262	283	297
35	152	197	211	235	247	272	285
30	146	181	197	213	228	257	263
25	145	168	172	201	215	239	245
20	96	161	162	178	197	231	228
15	82	149	145	164	183	214	201
10	38	128	126	115	159	187	171
5	35	107	106	91	120	140	123
1	35	91	57	44	53	76	28
0	35	91	57	25	43	25	4

Percentile	Age 15	16	17	18	19	20	21 and over
100	566	578	582	571	591	601	591
99	540	552	533	555	550	582	577
95	483	493	519	534	536	575	563
90	461	478	507	510	528	561	548
85	429	455	485	482	506	529	529
80	419	442	470	466	493	522	513
75	407	426	453	456	476	508	503
70	392	414	441	450	459	487	477
65	382	403	431	429	436	478	470
60	368	387	414	417	421	472	466
55	356	378	399	398	398	461	458
50	338	369	383	389	387	446	440
45	319	358	365	375	375	433	428
40	307	337	344	359	355	389	414
35	296	325	333	328	345	384	409
30	278	306	316	305	315	334	396
25	260	291	292	287	298	318	356
20	245	262	276	249	244	306	322
15	223	223	248	236	207	284	309
10	200	192	223	181	154	281	242
5	143	142	187	142	128	227	125
1	88	50	57	71	72	175	42
0	56	10	26	71	72	175	42

TABLE 9

Table for the Conversion of Percentiles into Indices

P.	I.	P.	I.	P.	I	P.	I
1	10	26	40	51	50	76	60
2	18	27	41	52	51	77	61
3	21	28	41	53	51	78	61
4	23	29	42	54	51	79	62
5	25	30	42	55	52	80	62
6	26	31	42	56	52	81	63
7	28	32	43	57	52	82	63
8	29	33	43	58	53	83	64
9	30	34	44	59	53	84	64
10	31	35	44	60	54	85	65
11	31	36	45	61	54	86	66
12	32	37	45	62	54	87	66
13	33	38	45	63	55	88	67
14	34	39	46	64	55	89	68
15	34	40	46	65	55	90	69
16	35	41	46	66	56	91	69
17	36	42	47	67	56	92	70
18	36	43	47	68	57	93	71
19	37	44	48	69	57	94	72
20	37	45	48	70	58	95	74
21	38	46	48	71	58	96	75
22	38	47	49	72	58	97	77
23	39	48	49	73	59	98	79
24	39	49	49	74	59	99	82
25	40	50	50	75	60	100	90

P. = Percentile I. = Index

The same table is used for both the Non-language and the Educational Tests. Record these indices in the spaces marked for them on the card. Turn the Educational percentile into an index and record after "Ed. In. Age" (educational index according to age). Similarly change the mental percentile into an index and record after "Mental In." (mental index).[1] In the next space below record the difference, subtracting the mental from the educational index, using plus and minus signs.

The large booklets can now be laid aside, since all the data have now been transferred to the cards. This method facilitates the handling of the data.

[1] The two spaces on the card "Ed. % Grade" (educational percentile according to grade) and "Ed. In. Grade" (educational index according to grade) are not used for deaf children. They are used for hearing children for whom grade percentiles for the educational tests have been calculated.

CHAPTER VI

Comparison of Schools Tested

1. Educational and Mental Indices.

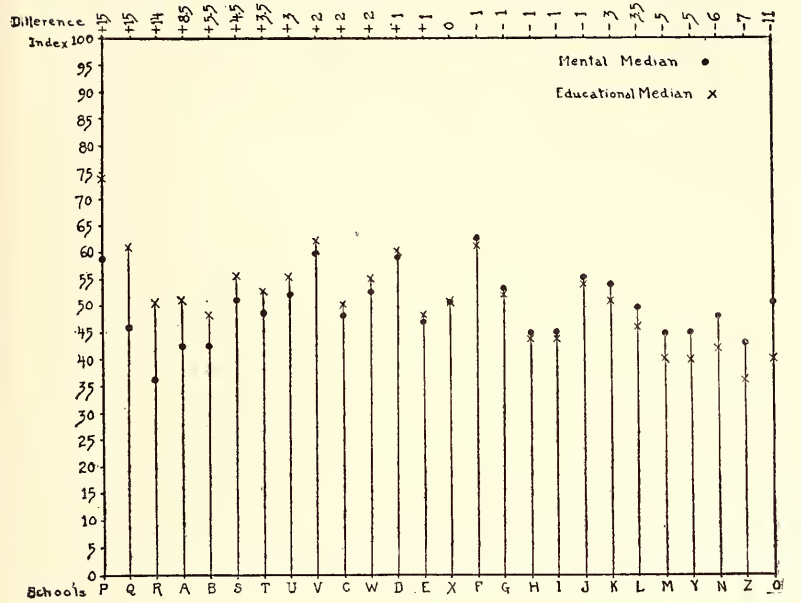
Public hearing schools have for some time been making use of group tests to compare schools in various parts of the system and also to compare different school systems, in order to test both the general ability of the student body and also their educational attainments. The need of a quick, simple and accurate means of comparison seems to be even more pressing in deaf school work, partly because the deaf school system is more national in scope, although under the control of each individual state, and also because of the existence of two radically different kinds of deaf schools, namely day schools and institutions.

In order to compare the schools in general, and these two types of deaf school, in particular, the median indices for each school have been calculated. Subtraction of the median mental index from the median educational index gives the "Difference," which indicates whether the school is doing better or poorer educational work than the mentality of the pupil material warrants, and, therefore, the "Difference" serves to denote by a single, simple value the standing of the school.

Figure A shows the twenty-six schools arranged in rank order according to this "Difference." The range of differences is from +5 points to —11 points. This difference between the mental and educational medians for each school is given on the top of the figure. The advantage of such a graph is to show at a glance exactly where any one school stands in comparison with the others. The schools are arranged in the order of the difference from the highest plus differences down to zero difference and then up to the highest minus differences. Those schools having plus differences, that is, where the median educational index is above the mental, are schools that are accomplishing more educational work than is ordinarily accomplished in deaf schools, taking

FIGURE A

Schools-According To Differences between Indices


Difference
Index
+15 +15 +14 +13 +12 +11 +10 +9 +8 +7 +6 +5 +4 +3 +2 +1 0 -1 -2 -3 -4 -5 -6 -7 -11
100 95 90 85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10 5 0
Mental Median •
Educational Median ×
Schools P Q R A B S T U V C W D E X F G H I J K L M Y N Z O

into account the mental caliber of the pupils. This may be said to be true of the schools denoted by the letters P, Q, R, A, B, S, T, U, V, C, and W. Conversely those schools having minus differences are schools that are accomplishing less than is ordinarily accomplished, again taking into due consideration the mental caliber of their pupils. In these schools there is good mental material going to waste. The schools are not using the intelligence of their pupils to the best advantage. This is true of the schools at the right hand side of the picture, where in each case the mental index is higher than the educational. These schools are K, L, M, Y, N, Z and O. Between these two groups already mentioned lies an intermediate group, schools D, E, X, F, G, H, I, and J, where the difference between the two indices is so small as to indicate that the schools are doing average work in comparison with the mental ability of their pupils. School X, in this group, actually has the same index both mentally and educationally, and therefore, has a difference of zero.

To sum up our groups, we might say that the first group is exploiting to the full the intellectual resources of its pupil material; the second group is sadly wasting these resources; and the third, or intermediate group, is maintaining a normal output.

In addition to this general comparison of groups of schools, the graph enables us to make more detailed comparisons between schools which have about the same mentality or about the same educational attainment. If we take for instance schools A and B, with children of exactly the same mental caliber, we note that A is doing somewhat better educational work than B, showing that school B has the possibility of doing better work. The differences may arise from any number of causes which are not brought out by the tests.

On the other hand, if school A is compared with school R, which has very much poorer mental stock to work with, we see that school R is doing practically as good educational work as school A. Or, again, let us take several schools of about the same mental caliber, say, an index of 45, which is a little below average, and let us compare the educational work of the schools. Schools Q, H, I, M, and Y have all a mental index of 45 or 46. School Q, however, has an educational index of 61, schools H and I of 44, whereas M and Y drop down to 40. The superintendents of schools M and Y ought to be greatly concerned as to why their schools possessing as good mental material as H and I, are, nevertheless, so far below them educationally. Is the organization of the school at fault, or the methods of teaching or the quality of the teachers, or the attendance of the pupils, or what?

It is interesting to note further that good mental caliber in a school does not guarantee good educational attainment. We note schools of good mentality doing poor educational work as well as good educational work. School O has good pupil-material but is doing poor educational work. Conversely we note that the school with the poorest mental material, school R, is doing creditable educational work. These and similar comparisons, which our graph allows, should prove of great value to the serious and progressive superintendent.

2. *Comparison of Day Schools and Institutions.*

TABLE 10

Schools arranged in order of Differences of Indices

School	Difference	Median Indices		Number of Children
		Menta	Education	
*P	+15	59	74	4
*Q	+15	46	61	9
*R	+14	36.5	50.5	10
A	+ 8.5	42.5	51	244
B	+ 5.5	42.5	48	164
*S	+ 4.5	51	55.5	52
*T	+ 3.5	49	52.5	128
*U	+ 3	52	55	57
*V	+ 2	60	62	17
C	+ 2	48	50	113
*W	+ 2	52.5	54.5	62
D	+ 1	59	60	127
E	+ 1	47	48	93
*X	0	50.5	50.5	38
F	— 1	62.5	61.5	100
G	— 1	53	52	93
H	— 1	45	44	51
I	— 1	45	44	26
J	— 1	55	54	156
K	— 3	54	51	182
L	— 3.5	49.5	46	118
M	— 5	45	40	149
*Y	— 5	45	40	9
N	— 6	48	42	119
*Z	— 7	43	36	9
O	—11	51	40	42

* Day Schools

In Table 10 the institutions are represented by the letters A to O, inclusive, while P to Z, inclusive, denote the Day Schools. There are included in this tabulation 15 institutions and 11 day schools. They are arranged in the order of Differences, from the highest plus to the highest minus Difference. Out of 11 day schools, 9 show zero or plus differences of mental and educational indices, while only five of the fifteen institutions show plus indices.

Examining the median mental indices in the table we find the usual supposition borne out that the day schools attract the brighter children. Fifty-four and five-tenths percent of the day schools show median mental indices above 50, eight-one and eight-tenths percent of the day schools show median educational indices above 50, while only 46.6 percent of the institutions are

doing average or above average work. This may be summarized as follows:

PERCENTAGE OF SCHOOLS WITH MEDIAN INDICES OF 50 OR ABOVE

Test	Day Schools	Institutions	Difference in Percentages
Educational	81.8%	46.6%	35.2%
Mental	54.5%	46.0%	14.5%

This shows 20.7 percent better results obtained by the day schools.

This comparison seems to bear out the statement that the better results obtained by the day schools seem to be due to factors other than the native ability of the children.

3. Distribution of Mental and Educational Ratings in each School.

Table 11 gives the actual number of children in each school distributed for the mental test into five groups; dull, backward, normal, bright and very bright. For the educational test there are, likewise, five groups designated very poor, poor, average, good, and very good. At the bottom of the table is to be found the distribution for the 2172 cases.

Table 12 shows the same data in terms of percentages. Schools can be compared for the percentage of children falling in any group by simply running down the column. Some schools show considerable differences when the dull group on the mental test is compared to the very poor group on the educational test, or the backward compared to the poor group, and so forth.

Figure B gives a picture of each of the mental ratings with the schools arranged in order of percentages from the highest to the lowest. In the very bright group only 14 out of the 26 schools show children of very exceptional ability. The percentages of very bright children in the separate schools range from 0 to 5.6 percent. This range is just about what might be expected since arbitrarily we called only the highest 2.2 percent of our total group "very bright."

All the twenty-six schools are represented in the bright group with the exception of two. The separate schools in this group of bright children show percentages ranging from 0 to 60 percent of their student body. In our total distribution we assumed

NON-LANGUAGE TEST

Distribution of Schools in the Five Groups

Figure B

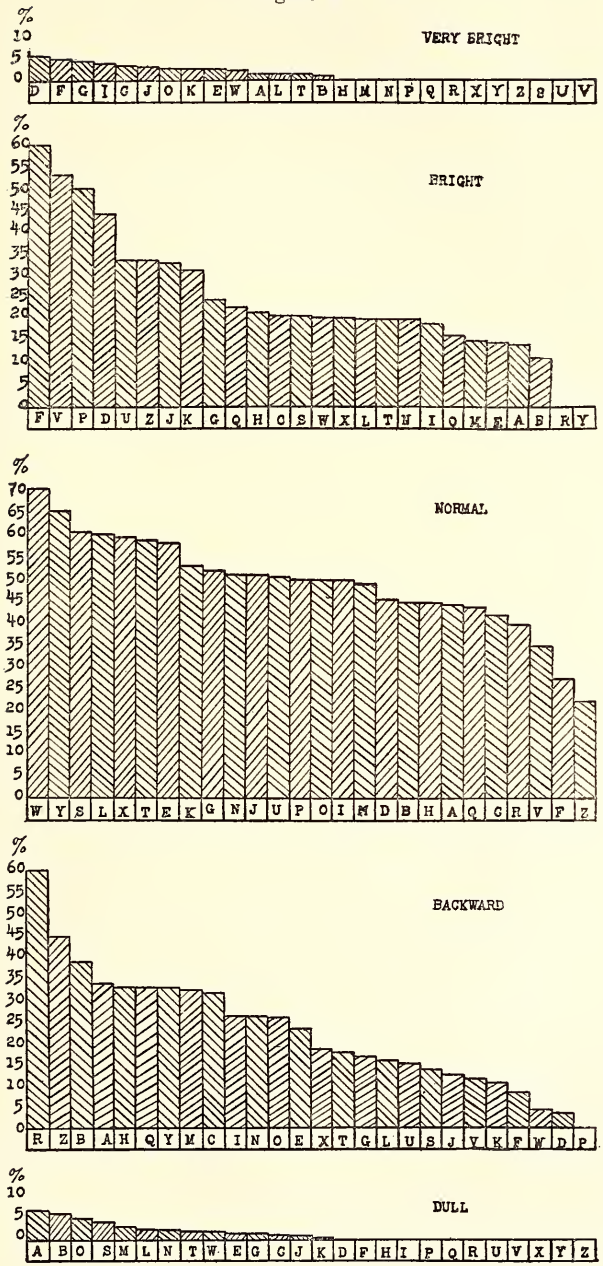


TABLE 11

Distribution showing Number of Children at each Level

Mental						School	Education					
Totals	Dull	Backwd.	Norm.	Bright	Vr. Br.		Vr. Poor	Poor	Average	Good	Vr. Good	Totals
244	14	84	109	35	2	A	1	48	138	56	1	244
164	9	63	74	17	1	B	13	65	66	19	1	164
113	1	36	48	24	4	C		23	69	20	1	113
127		6	58	56	7	D	1	5	57	55	9	127
93	1	22	54	14	2	E	1	22	57	13		93
100		8	27	60	5	F		6	39	49	6	100
93	1	16	49	23	4	G		16	46	30	1	93
51		17	23	11		H	1	17	24	9		51
26		7	13	5	1	I	2	7	12	5		26
156	1	20	80	51	4	J	1	15	87	49	4	156
182	1	21	98	58	4	K		32	111	38	1	182
118	2	19	72	24	1	L		34	69	15		118
149	4	49	73	23		M	5	65	61	18		149
119	2	32	61	24		N	4	46	51	17	1	119
42	2	11	21	7	1	O	3	18	18	2	1	42
4			2	2		P			1	3		4
9		3	4	2		Q		2	2	5		9
10		6	4			R		2	5	3		10
52	2	7	32	11		S		5	25	16	6	52
128	2	23	76	26	1	T		20	64	41	3	128
57		9	29	19		U		11	21	23	2	57
17		2	6	9		V		4	4	8	1	17
62	1	3	44	13	1	W	2	10	25	24	1	62
38		7	23	8		X	1	9	16	12		38
9		3	6			Y		4	5			9
9		4	2	3		Z	1	4	1	3		9
2172	43	478	1088	525	38		36	490	1074	533	39	2172

TABLE 12

Percentage Distribution for Each School

Mental						School	Educational					
Totals	Dull	Backwd.	Norm.	Bright	Vr. Br.		Vr. Poor	Poor	Average	Good	Vr. Good	Total
99.9	5.7	34.4	44.7	14.3	0.8	A	0.4	19.7	56.5	23.0	0.4	100.0
100.0	5.5	38.4	45.1	10.4	0.6	B	7.9	39.6	40.2	11.6	0.6	99.9
99.9	0.9	31.8	42.5	21.2	3.5	C		20.4	61.0	17.7	0.9	100.0
100.1		4.7	45.7	44.1	5.6	D	0.8	3.9	44.9	43.4	7.1	100.1
99.9	1.1	23.6	58.0	15.0	2.2	E	1.1	23.6	61.3	14.0		100.0
100.0		8.0	27.0	60.0	5.0	F		6.0	39.0	49.0	6.0	100.0
100.0	1.1	17.2	52.7	24.7	4.3	G		17.2	49.5	32.2	1.1	100.0
100.0		33.3	45.1	21.6		H	2.0	33.3	47.0	17.7		100.0
99.9		26.9	50.0	19.2	3.8	I	7.7	26.9	46.2	19.2		100.0
99.9	0.6	12.8	51.2	32.7	2.6	J	0.6	9.7	55.8	31.4	2.6	100.1
99.8	0.5	11.5	53.8	31.8	2.2	K		17.6	61.0	20.8	0.5	99.9
100.0	1.7	16.1	61.0	20.4	0.8	L		28.8	58.5	12.7		100.0
100.0	2.7	32.9	49.0	15.4		M	3.4	43.6	41.0	12.1		100.1
100.0	1.7	26.9	51.2	20.2		N	3.4	38.6	42.8	14.3	0.8	99.9
100.1	4.8	26.2	50.0	16.7	2.4	O	7.1	42.8	42.8	4.8	2.4	99.9
100.0			50.0	50.0		P			25.0	75.0		100.0
99.9		33.3	44.4	22.2		Q		22.2	22.2	55.5		99.9
100.0		60.0	40.0			R		20.0	50.0	30.0		100.0
100.0	3.8	13.5	61.5	21.2		S		9.6	48.1	30.8	11.5	100.0
100.0	1.6	17.9	59.4	20.3	0.8	T		15.6	50.0	32.0	2.3	99.9
100.0		15.8	50.9	33.3		U		19.3	36.8	40.4	3.5	100.0
100.0		11.7	35.3	53.0		V		23.5	23.5	47.0	5.9	99.9
100.0	1.6	4.8	71.0	21.0	1.6	W	3.2	16.1	40.3	38.8	1.6	100.0
99.9		18.4	60.5	21.0		X	2.6	23.7	42.0	31.6		99.9
99.9		33.3	66.6			Y		44.4	55.5			99.9
99.9		44.4	22.2	33.3		Z	11.1	44.4	11.1	33.3		99.9
99.97	1.98	22.00	50.09	24.15	1.75		1.66	22.53	49.40	24.51	1.79	99.89

22.8 percent fell in the bright group. With this assumption it is rather surprising to have schools showing 50, 55 and 60 percent of their pupils falling in this group.

All schools are represented in the normal group and here the range is about the same but the curve naturally does not show such a sudden drop. The range is from 22 percent to 71 percent. Fifty percent of the total distribution is assumed to be in the normal group.

The backward group shows the same range of percentages in the separate schools as the bright group, that is from 0 to 60 percent. In the total distribution 22.8 percent of all cases are included in this backward group.

The dull group again has a small range from 0 to 5.7 percent. Arbitrarily this group is made to include the same percentage as the very bright group, that is 2.2 percent.

This figure supplies a quick means of comparing schools with regard to any given group of children. Suppose the superintendent of School F wished to compare his school with School A as regards the percentage of bright children, this picture would give him the information at a glance.

Figure C shows the schools arranged according to the percentages of pupils falling in the five groups on the educational test: very good, good, average, poor, and very poor.

The very good group shows a range of from 0 to 11.5 percent. The range of the good group is from 0 to 75 percent, making a steep curve. The average group includes all the schools and with a more gradual descent shows a range from 11.1 to 61.3 percent. The poor group has a range from 0 to 44.4 percent with a gradual drop. Finally the very poor group shows a range from 0 to 11.1 percent. The same arbitrary percentage of cases in each of the five groups was used for the total distribution on the educational test as has been described above for the mental test.

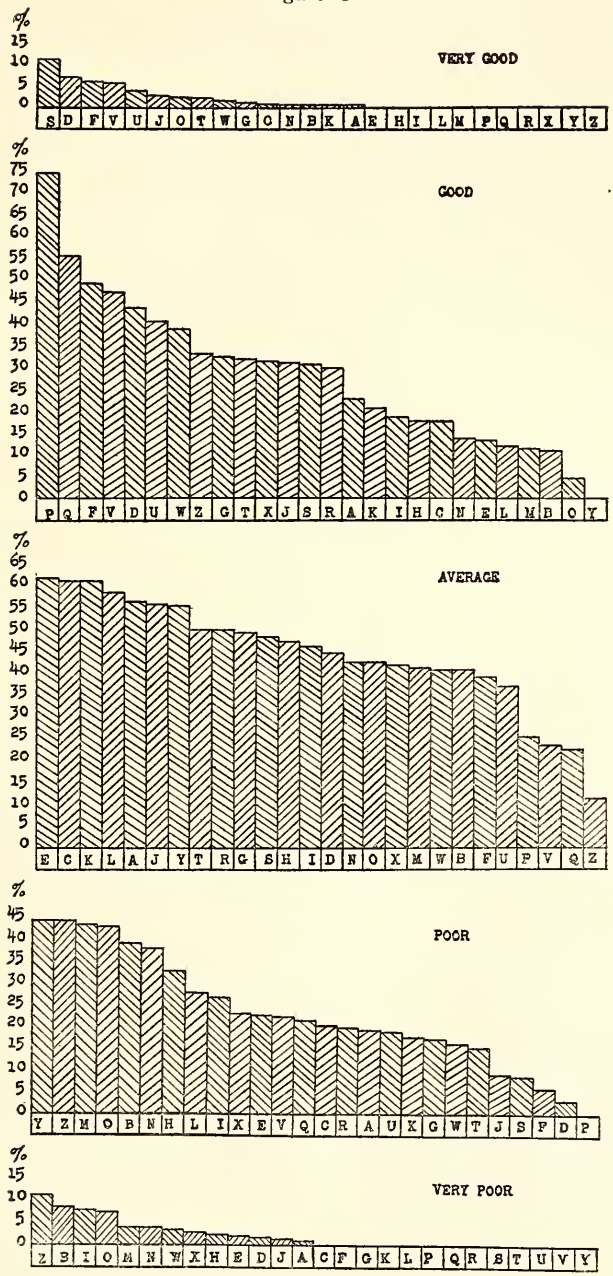
4. Comparison of Institutions and Day Schools as to the Percentages of Pupils in the Five Groups.

Table 13 gives a distribution of the children into the five

EDUCATION TEST

Distribution of Schools in the Five Groups

Figure C



groups, according to whether they are in Institution schools or public Day schools. Examining the percentage of dull children on the mental test in the two types of schools we find the Institutions showing 2.14 percent and the Day schools only 1.27 percent. A difference of 0.87 percent or not quite 1 percent. The backward groups show a difference of 6.15 percent. The normal group, a difference of 9.29 percent. These three differences are all in favor of the Day schools, indicating a smaller percentage of below normal pupils and a larger percentage of normal. The next two or highest groups show differences in favor of the Institutions, that is .79 percent or not quite 1 percent more bright and 1.53 percent more very bright children. Here we seem to have a rather balanced distribution of mental ability between the two types of schools. While the Day schools do not have quite so many dull and backward children, neither do they have so many bright or very bright children.

TABLE 13

Distribution of all Cases into Five Groups—Non-language Test
Institutions and Day Schools

	Institutions		Day Schools		All Cases	
	No.	%	No.	%	No.	%
Dull	38	2.14	5	1.27	43	1.98
Backward	411	23.10	67	16.95	478	22.00
Normal	860	48.40	228	57.69	1088	50.09
Bright	432	24.30	93	23.51	525	24.15
Very Bright	36	2.03	2	0.50	38	1.75
Total	1777	99.97	395	99.92	2172	99.97

TABLE 14

Distribution of All Cases into Five Groups—Education Test
Institutions and Day Schools

	Institutions		Day Schools		All Cases	
	No.	%	No.	%	No.	%
Very Poor	32	1.80	4	1.01	36	1.66
Poor	419	23.58	71	17.95	490	22.53
Average	905	50.90	169	42.70	1074	49.40
Good	395	22.20	138	34.91	533	24.51
Very Good	26	1.46	13	3.29	39	1.79
Total	1777	99.94	395	99.86	2172	99.89

Comparing the Institutions and Day schools on the Educational Scale, Table 14, by groups we find that the very poor groups show a difference of 0.79 percent; the poor groups a difference of 5.63 percent; the average groups a difference of 8.20 percent. These

differences are in favor of the Day schools or, in other words, the Institutions turn out that much higher percentage of poor or average educational work.

The two highest groups also show differences in favor of the Day schools. The good groups give a difference of 12.71 percent, and the very good, a difference of 1.83 percent.

A comparison of these differences on the mental and educational tests would seem to show that both the Institutions and Day schools make the most of their poor mental material. With the bright children, however, we note that the percentage of these cases in Institutions is really slightly in excess of that in Day schools, but in the corresponding educational groups we find the most marked differences. It would seem that this is the group which profits most from the methods used by and the more individual attention of the Day schools. The final comparison for the superior group shows the Institutions favored in numbers, but it appears from the educational test that they do not make as much out of this native ability as do the Day schools. This lack of attention by the Institutions to the brighter children is reflected in the percentage of average pupils in the educational test, which is higher than the percentage of normal on the mental test. Evidently the Institutions are content to let many of the brighter children do merely average educational work.

It does not seem possible to draw any other conclusions from these results than that the children in the two types of schools on the whole are approximately the same caliber, and also that Day schools do turn out students with better educational attainment. Is this due to better teaching, smaller classes, more normal out-of-school-hours life, or to mingling with hearing or only semi-deaf people? These are interesting questions that merit further consideration for they cannot be answered from the results of these tests alone.

5. *Analysis of Mentality and Educational Attainment of Each School.*

In addition to the comparison of schools that we have made so far, we can also analyze more in detail the make-up of each school, particularly from the point of view as to what it is doing

educationally with the mentality at its disposal. Our double measure of the pupil material allows us to do this very thoroughly. We can raise such questions as: Are there more poor children shown on the educational test than there are dull children mentally? Are there more mentally average children than educationally average? If so, where are they? Have they been pushed up the educational scale or have they slipped back? These displacements may arise from any number of reasons: teaching conditions, temperament of children, physical and social conditions, et cetera.

Figure D gives a picture for each of the twenty-six schools tested, in terms of percentages of children in each group on the two test series. The shaded areas represent the non-language or mental groups, while the white areas show the five groups on the educational test. To indicate good educational work the white areas should be equal or less than the shaded areas in the "dull" and "backward" groups, while the white columns for "normal," "bright," and "very bright" should equal or exceed the shaded areas.

A few comments may be made on each school:

School A. Rather large percentage of below normal children but doing particularly good educational work.

School B. Fairly uniform mental distribution and producing work which corresponds almost exactly.

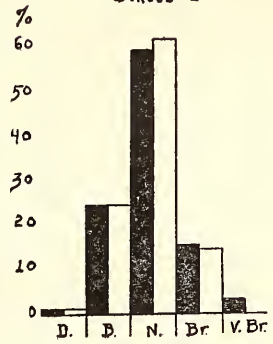
School C. Large percentage of backward students, but a good showing in normal educational work, indicating that many of those backward mentally are doing average work.

School D. A larger than usual number of normal and bright children doing the kind of work which should be expected of them.

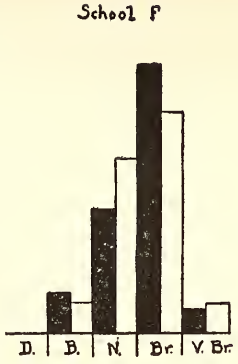
School E. Rather high percentage of normals. All groups attain the educational levels which are to be expected.

School F. Unusual number of bright students not doing quite all that might be hoped. Many are evidently doing only average work as indicated by the excess in the white column at normal. The normal and very bright groups showing more educationally than ordinarily would be expected.

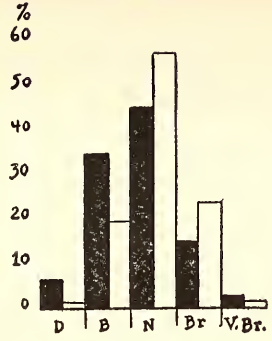
School E



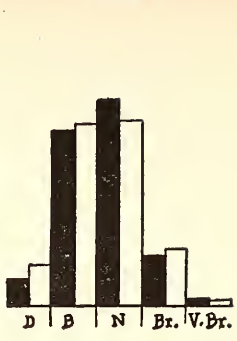
School F



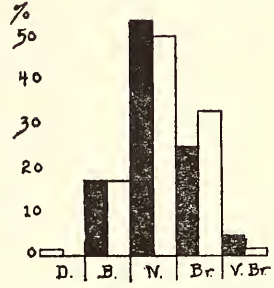
School A



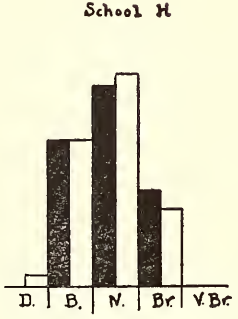
School B



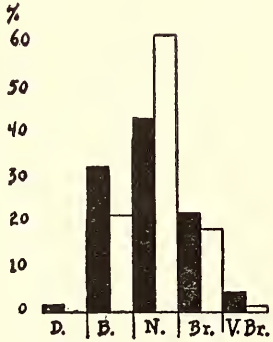
School G



School H



School C



School D

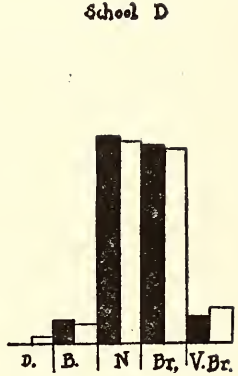


FIGURE D—Continued

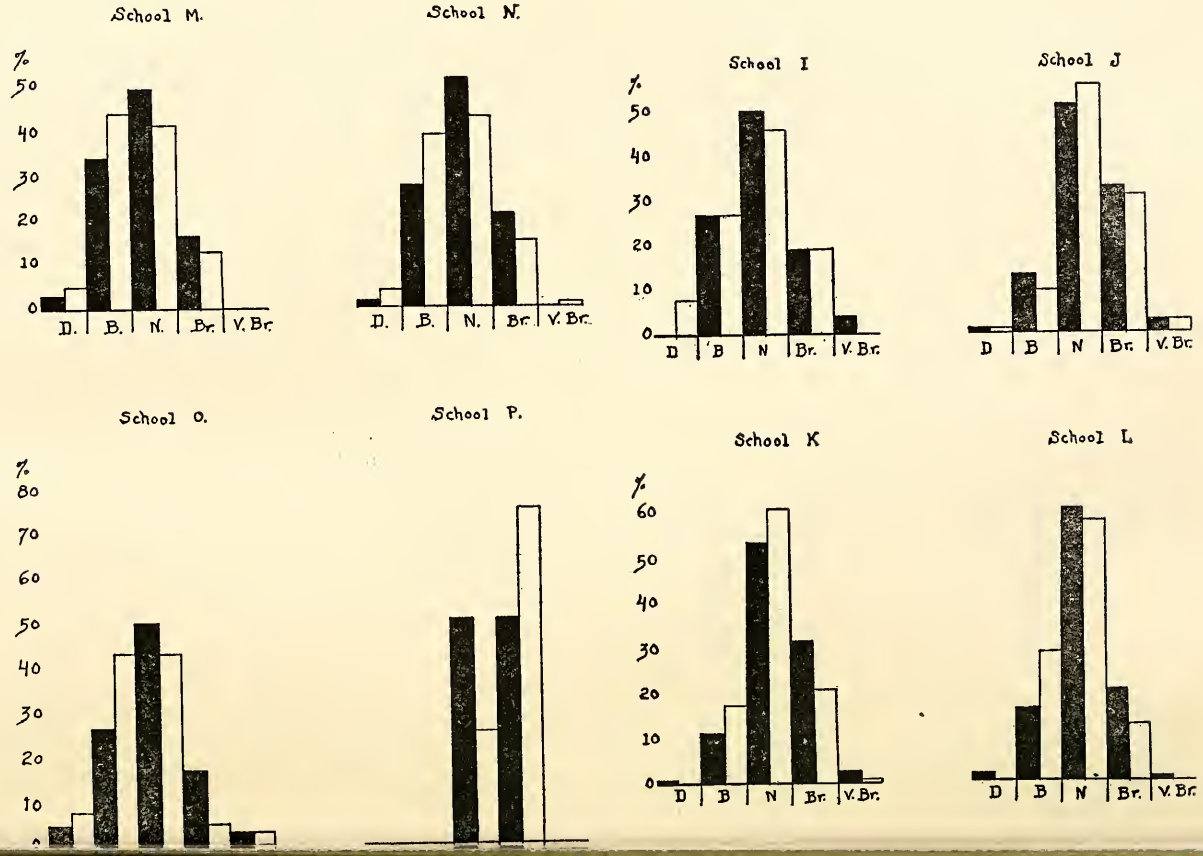


FIGURE D—Continued

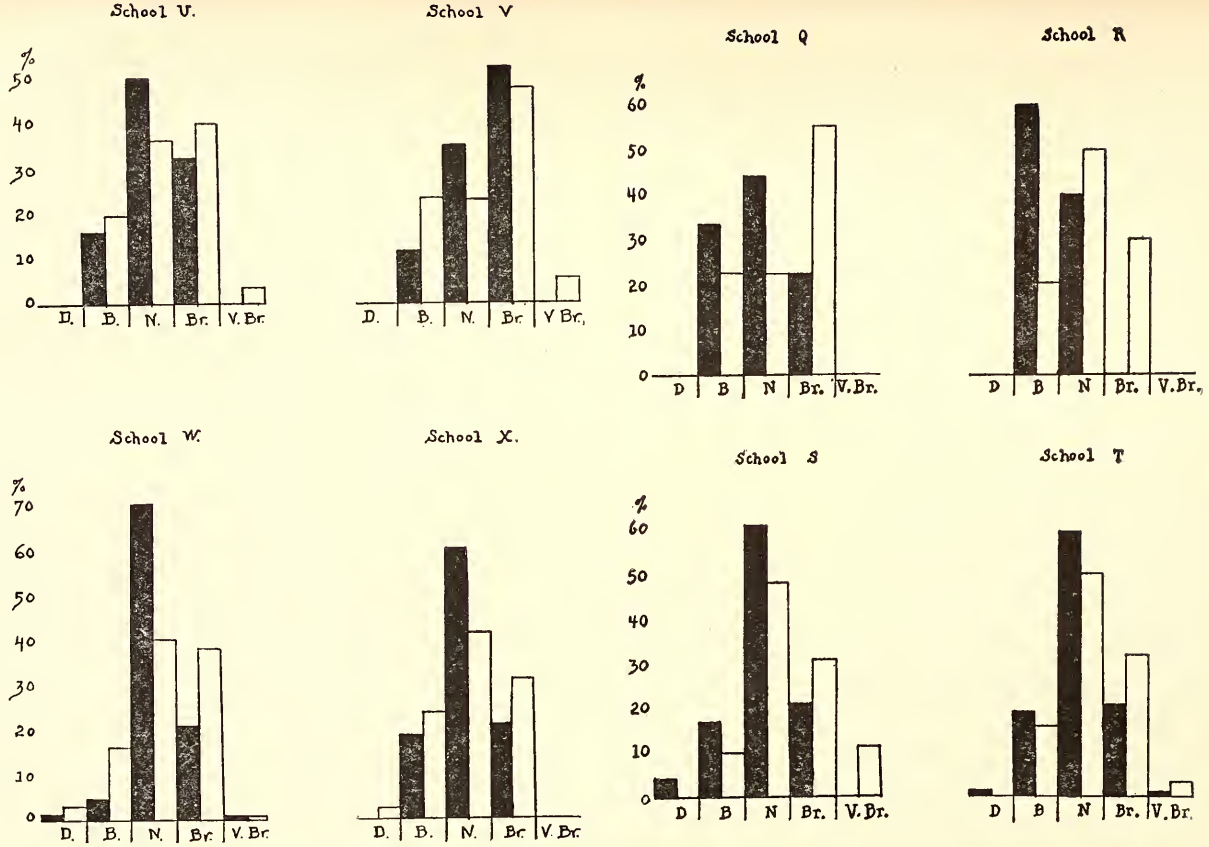
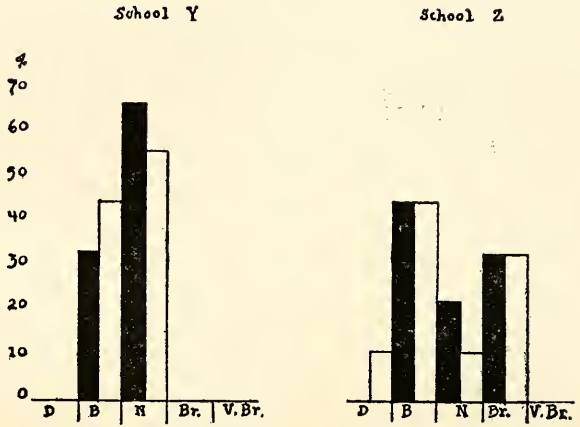


FIGURE D—Continued



School G. Shows good work with normal children, because many must be doing good educational work. Seems to be a tendency to neglect the very bright and let them slip down from very good to merely good work.

School H. Represented by only the three middle groups mentally, shows a tendency to let the educational attainment slip back slightly.

School I. Fairly normal distribution mentally, but it does not utilize the very bright material and allows far too large a percentage of very poor educational accomplishment. Very bright pupils neglected.

School J. A very small number of low grade mental children. Shows only fair educational work.

School K. Doing very well educationally with the normal and dull groups, but there is room for improvement in the other groups.

School L. Shows a normal distribution of mental ratings in each of the five groups. However with the exception of the dull group this school is not obtaining the results it should.

School M. Rather a large percentage of backward children compared to the other groups, but even so, better educational results could be obtained. There is a tendency to let many normal children slip back into poor educational work.

School N. Normal mental distribution of children but poor work in all groups except in the very bright group and that is very slight.

School O. Normal mental distribution and very poor educational work except in the very bright group.

School P. Unusual mental grouping. Good educational work in as much as about half of the normal children are doing good work.

School Q. No dull or very bright pupils, but a large percentage of backward. Very good educational work, because many of the backward are obviously accomplishing average work and many of the normal are doing good work.

School R. With only backward and normal children to deal with this school is doing splendid educational work.

School S. This school with only a small percent of superior students is doing very fine educational work.

School T. With a rather large amount of average material this school is doing more than should be expected. It is pushing its normal material up into the good class.

School U. Has a large proportion of bright pupils and is doing very good work. Many of the bright are accomplishing very good work and many of the normal must be doing good work.

School V. Very irregular school. Some bright children obviously pushed up to very good work, but some normal allowed to slip back to poor work. Seems to show an emphasis on the bright child, an emphasis which is very exceptional.

School W. Overwhelming number of normal children. Good educational attainment with many of these, but many are also allowed to slip back into poor work. Emphasis of the school very uneven. There seems to be no consistent policy.

School X. Other than not showing any pupils at either extreme this curve is quite symmetrical for the mental grouping. The educational work is about average. A few are pushed up to good work and a few are allowed to drop back to poor and very poor work.

School Y. With only the two mental types to deal with this school is doing very poor educational work for those they have.

School Z. This shows a most unusual mental grouping with an excess of backward and bright students, and very few normal. Educationally the bright students are working up to expectations, but some of the normals have been allowed to slip back to poor work and very probably some of the backward to very poor work. There is far too large a percentage doing very poor work.

CHAPTER VII

Application of the Tests to the Problems of Deaf Schools

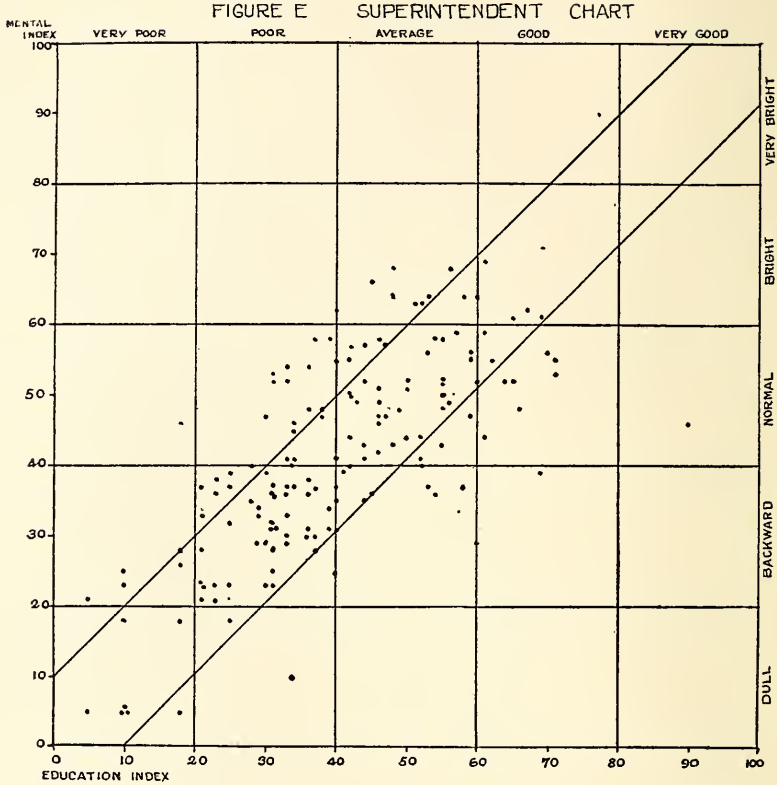
One of the first questions which was always asked the writer on entering a new school was—In what way can this school profit by these Tests? This chapter is an attempt to answer that question. The superintendent is naturally interested in his school as a whole, not only as compared with other schools but also as to the make-up within itself.

The Figures E, F, G, are of three separate schools. Every child in each school is represented on these charts by a particular dot. If the charts were to be actually used in the school the dots could be numbered and a key of the child's name and number kept for reference. Thus at any time any individual child could be located and a record of his educational attainment with reference to his native ability obtained at a glance.

The vertical column gives the mental index, that is the nearer the top of the chart the higher the mental index and the brighter the child. Along the base line are shown the educational indices. The nearer the child approaches the right-hand side of the chart the better educational work he is doing. The two diagonal lines are drawn to include all cases having a difference of from plus ten to minus ten. Differences lying between these two limits are in all probability not significant. Theoretically all children should fall somewhere between these two lines, since that shows they are accomplishing the amount of educational work that is to be expected of their mental ability. We can, therefore, see at a glance the mental and educational diagnosis of each child.

All children having mental indices between 80 and 100 are called "very bright" and will therefore be found somewhere on the top row of the chart. Into which of the five divisions of the top row any particular case will fall, will depend upon his educational rating. If this educational index is between 0 and

FIGURE E SUPERINTENDENT CHART



20, or "very poor," he will be found in the first square at the top left-hand corner; if his index is between 20 and 40 or "poor," he will be found in the second square and so on. Obviously we should expect "very bright" children to be doing "very good" educational work; "bright" children to be doing "good" educational work; "normal" children to be doing "average" educational work, and so on.

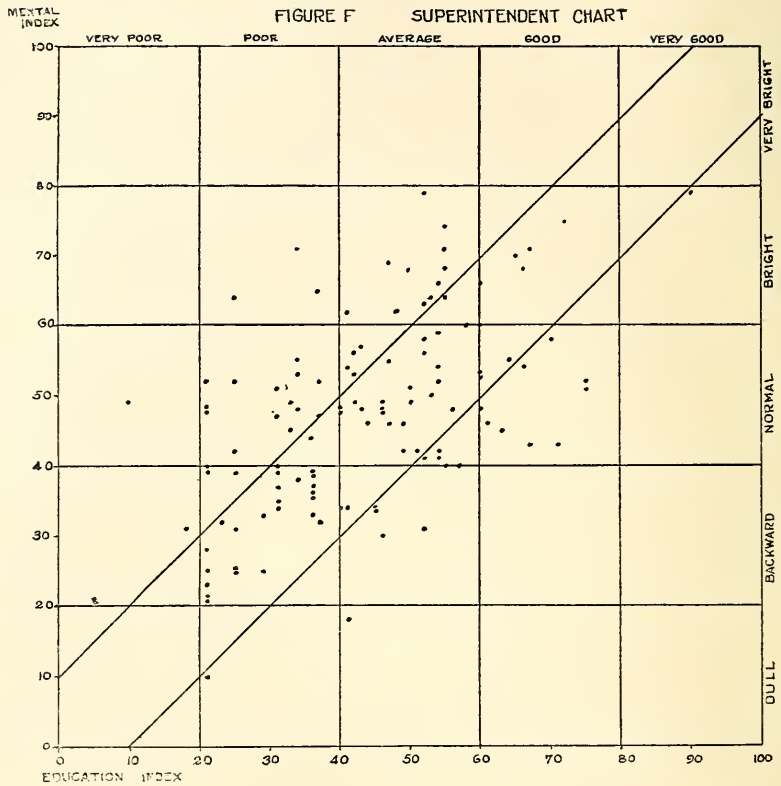
Those children falling in the upper left-hand triangle are those who have much better mental ability than they seem to be applying to their educational work, that is, the difference between the mental and educational indices is greater than minus ten. This difference means that by different teaching, improved health, bet-

ter methods of study or some other remedy these children can be brought over into the group doing regular work. Lastly, the children falling in the lower right-hand triangle are those who are doing much better educational work than would ordinarily be expected of them. The differences between the mental and educational indices in these cases are all greater than plus ten.

Previously we asked the question—Which children are dropping back and which are being pushed up? This chart will help us to answer this question. Look at Figure E. A school of average ability doing average work on the whole as evidenced by the grouping in the center of the field. The mental median of this school is 42.5 and the educational median 48. However, there is quite a group of children, ranging all the way from a few of "poor" mentality to the brightest child in the school, doing school work which is below their individual capacities. These cases should be investigated and the cause of this educational retardation removed if possible.

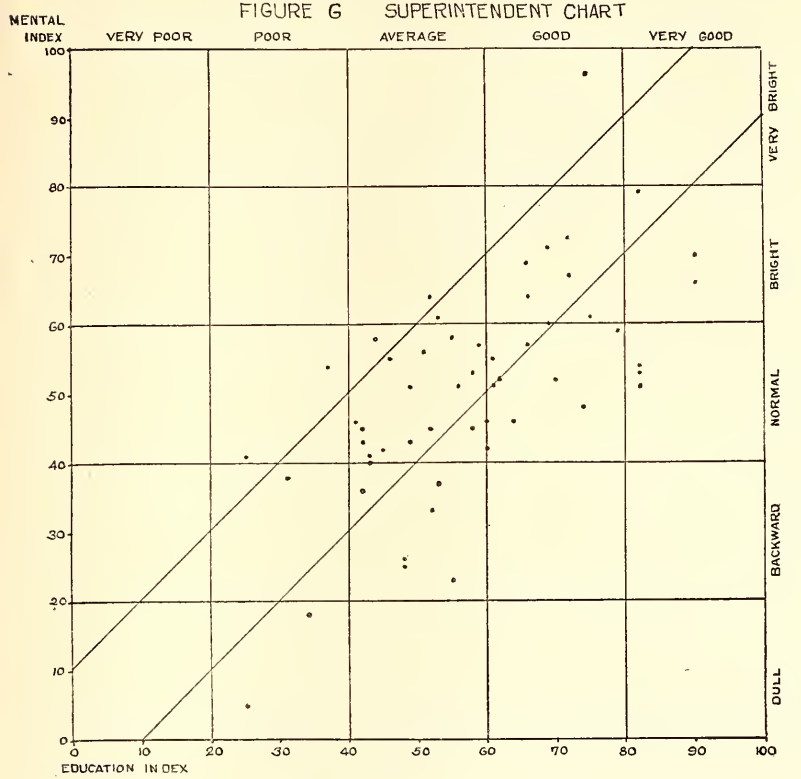
On the other hand, turning to those children who are doing better work than would ordinarily be expected of their mentality, we find a few of very low mentality and the remainder of average mental ability. As a matter of fact there are 37 cases in the upper triangle and 20 in the lower. There are a few more cases of children who are not working up to their intellectual capacity than there are cases of children accomplishing more than is regularly accomplished. This discrepancy between the two groups is, however, not great. The distribution of these two groups of accelerated and retarded children is interesting. All the accelerated fall below an index of 60, indicating children of normal or less than normal intelligence. Among the retarded we find a scattering at all degrees of intelligence. Ten of the thirty-seven, or 27 percent, are actually bright or very bright mentally. Obviously the school is paying most attention to the normal or dull child and is satisfied if the bright child accomplishes merely average educational work.

Figure F is a picture of a somewhat smaller school. The difference is found in the number of average children, since it happens that there are just about the same number of retarded and



accelerated children in the two schools, although of course the percentages are much larger in Figure F. Here, also, with the exception of one child, the mentally low and average are the ones which are being pushed up to do the best educational work while the mentally bright students are dropping back to average and even below average educational attainment. This school proportionately shows more bright material going to waste than the school of Figure E. Fourteen children or 35.9 percent of the educationally average or backward group have a mental index of 60 or above, that is, they are superior children. The one bright child who is doing superior educational work does not show a plus difference large enough to warrant any special remarks, being just over the line for the plus ten difference.

FIGURE G SUPERINTENDENT CHART



The last, Figure G, shows a relatively small school. Only four cases or 7.7 percent of the pupils are doing less than can be expected of them. Twenty-eight children, or 53.8 percent, are doing regular educational work, while twenty pupils, or 38.4 percent of the children in this school are accelerated educationally. Only one bright child is falling back to average work. The other three are of average mentality. None of these four cases show extremely large minus differences. In this particular school we see that those who are doing unusually good educational work for their respective mental ability, are represented by all types of mentality from the lowest to the superior group. Three cases, or 15 percent of the educationally accelerated, are

of bright mentality, showing a mental index above 60. This is a much better showing than we have had in the other two schools.

The Coaching Teacher.

All the three schools, and particularly the first two, show a certain number of children who are not working up to capacity. These cases represent wasted intelligence. They have the capacity to do better school work, regardless of the fact that some of them may be doing satisfactory work in the grade in which they are at present.

With the crowded conditions of most of the schools and the full curricula, it is hardly fair to expect the regular teacher to accomplish more than the regular assignment for the grade. The best way to help eliminate this waste is by means of a coaching teacher, whose duty it would be to take these children for a certain period each day and try to stimulate the mentally bright to greater effort and to go into greater detail of explanation with the mentally slow.

After the retarded children have been brought up to regular work the next function of the coaching teacher is to attempt to accelerate the most promising of the regular students to do even better educational work. Any means whereby a child can acquire more thorough education in a shorter length of time is a saving to the child and to the state. The sooner a child becomes a producing member of society the better for his family and society at large.

Class Charts.

From this general discussion of the whole school it is obvious that the next logical step is to make the data of some use to the individual teacher. The same form of diagram may be used for a particular class. Each dot now shows immediately the relative standing of every child in the room. Which children will warrant extra exertion on the part of the teacher. Which ones will probably always be plodders.

Let us look at Figure H. This is a class of mostly superior children, with a few of average mentality. Over 50 percent of

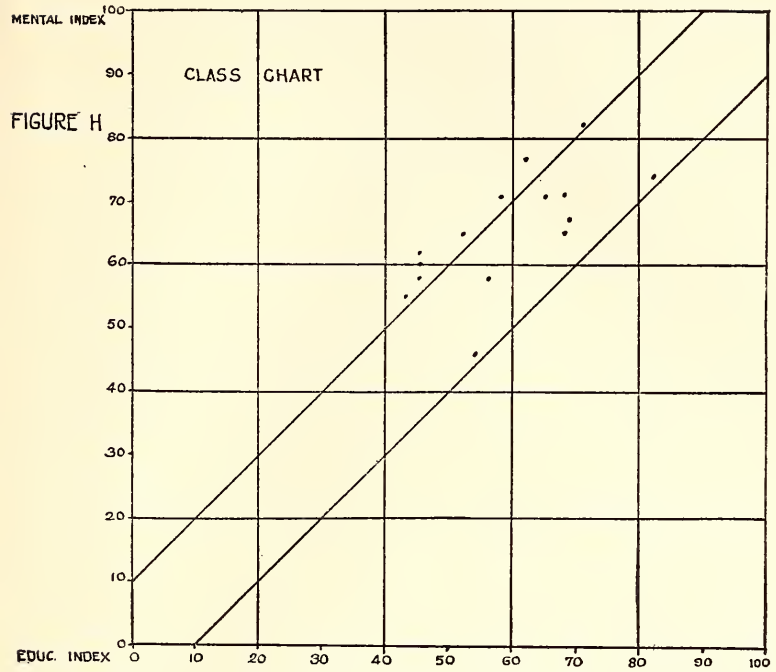


FIGURE H

this class is not attaining the educational work that they should and not a single case is doing exceptional work. An ambitious teacher certainly ought not be satisfied with this showing. It is her duty to analyze the case of every child falling to the left of the diagonal lines and to ask herself what she can do to urge each child on to greater attainment.

Figure I shows a class in an institution. This group has some poor material in it. We note that 22.7 percent of the pupils fall below expectation and 9 percent show plus differences of more than 10. There are three or four children who are obviously not accomplishing nearly as much as they should. The chart should serve to direct the teacher's attention to such cases. In a similar manner every class in a school could be charted and such charts ought to prove an immense stimulus to the teachers.

To be of most value, group tests should be given to the classes

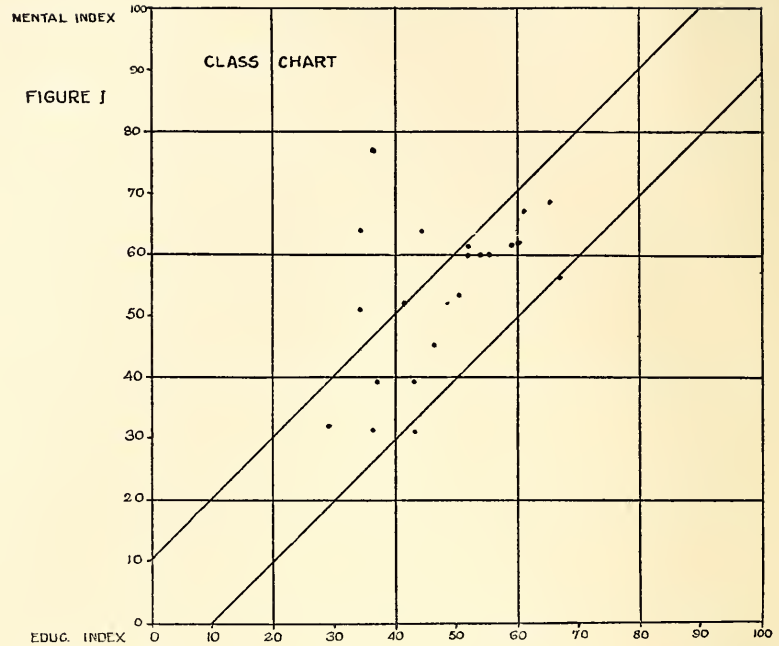


FIGURE I

at the beginning of the school year, and the charts promptly made out and interpreted. After the efforts of the teacher had been directed toward those students who most needed it, the test should be repeated at the end of the term. Readjustments could be made at this time without undue confusion, and coaching classes formed to care for the pupils showing irregular attainment in the second testing.

The late and irregular entry of children into deaf schools is more of a problem than in hearing schools since the compulsory attendance laws are usually not so strictly enforced. The question arises: How much has the child acquired before coming to school? In what grade of work would it be best to start him? Also, since the standards of different deaf schools vary a great deal, a child going from one school to another must be tried out in several different places before he is fitted into the system. May these tests not help to solve these very problems in a quicker and more efficient manner than the trial and error method?

Distribution According to Crude Scores and School Grades.

In one large Institution each grade was tested separately, so that we were able to get an accurate grade ranking for each child in the school. Table 15 gives the distribution of the children

TABLE 15

Distribution in an Institution according to Scores on the Non-language Test and School Grade

Score	Grades 3	4	5	6	7	8	9	10	11	12	Total
0- 49											
50- 99			1				1				2
100-149	2	3			1	1					7
150-199	6		1		1	1	2		1		12
200-249	3	1	1	1	1		2	1	1		11
250-299	3	1	4		1	1	4				14
300-349	1	3	5	2	3	3	4	3	1	1	26
350-399	1	2	2	3	2		4			1	15
400-449		2	1	4		4	2				13
450-499		1	1	1		1		2	2	1	9
500-549								1	1	1	3
550-600						1					1
	16	13	16	11	9	12	19	7	6	4	113

in the different grades according to the crude scores made on the Non-language test. Reading down the columns we see that there are wide ranges of scores in every grade from the third to the twelfth. The third grade shows scores from 100 to 400 and the eighth grade scores from 100 to 600, and so on through all the grades. Also it is to be noticed that there are two children making scores between 50 and 100 on the mental test, one is in the fifth grade, the other in the ninth. Is the child in the ninth grade capable of doing grade work so far above the other child? Again we find children with scores between 150 and 200 in grades from the third to the eleventh.

The idea arose that the great scattering might be accounted for, by the different ages at which deaf children enter school, and the varying length of time the different children have been in school. Therefore the same kind of a table was arranged, according to the crude scores on the educational test and school grades. This Table 16 shows less wide variations in scores within any grade, with the exception, perhaps, of grades 9 and 10, but any one score may be found in several different grades. For instance a score of 20 to 29 is found in every grade from the fourth to the tenth inclusive.

The range of scores falling between the diagonal lines on the

TABLE 16

Distribution in an Institution according to Scores on the Education Test and School Grade

Score	Grades 3	4	5	6	7	8	9	10	11	12	Total
0- 9	5	4		1							10
10- 19	10	6	9	4		1	3				33
20- 29		3	5	5	5	5	3	2			28
30- 39			1	1	3	6	8	1			20
40- 49			1		1	1	3	2	2		10
50- 59							1	1	2	2	6
60- 69							1		2		3
70- 79								1		2	3
80- 89											
90- 99											
100-109											
110-119											
110-119											
120-129											
130-139											
140-149											
	15	13	16	11	9	13	19	7	6	4	113

two tables, is chosen arbitrarily. In this case we took three steps. Theoretically, if each school grade represents a year of mental development, we would expect an increase in the scores from grade to grade. If the increments added to the score from year to year are equal, we should have all our cases coming nearer the diagonal line. Probably, however, the increment added to the score becomes less and less as the child advances in grade, so that we would not have a true diagonal. If this is the case, our school would appear fairly well graded as far as educational attainment is concerned, although the range of mental ability in the different grades is extremely wide.

Would not this school be able to do even better educational work if each grade was made up of a more homogeneous group of pupils? The possibility of securing this greater homogeneity in grades occurs, possibly only in larger institutions where it is necessary to have several classes doing the same grade of work.

The advantage of such an arrangement can be examined in one school where there were 42 children doing fifth grade school work. The forty-two children were arranged in order of rank according to their crude scores on the mental test. The scores ranged from the lowest of 58 to the highest of 468. Since the average deaf school class is from ten to twelve pupils we can divide our group into four classes, two with ten pupils each and two with eleven each. The slowest group shows a range of scores from 58 to 189 points. In the next group the scores are from 194 to 252 points. The third class represents scores from 267 to 341 points. The fourth and best fifth grade class would have scores ranging from 346 to 468 points. The differences in the four classes between the highest and the lowest scores are:

Fifth Grades

Lowest class	Difference	131	points
Second "	"	58	"
Third "	"	74	"
Highest "	"	122	"

Since the lowest and the highest classes naturally show the widest range of scores and the greatest differences in the number

of pupils in any of the classes, the less homogeneous should be the smallest. By such arrangement the lowest class may require two years to cover the fifth grade requirement but the highest class may cover the same amount of grade work in a half year.

Pintner[1] made a similar distribution of a group of children belonging to the same grade. There were twenty-nine pupils under four teachers. In no class did he find a homogeneous group and in one class he found the brightest and the worst pupils of the entire group. Such lack of uniformity makes the teacher's task of conducting the class work more difficult. It, likewise, certainly wastes the time of the bright pupil, if he must wait until the teacher has drilled the dull pupil, before securing attention.

System is a thing to be used to the best interest of the child and not rigidly followed to the extent of sacrificing that interest, therefore, the methods and type of studies should be adapted to the ability of the individual child as far as possible. From a material point of view the quickest and most accurate means of classifying the child should be employed, since it costs the state eight times as much to educate deaf children in an institution and four times as much in a day school[2] as it does to educate children in the public hearing schools. The fact that the deaf child is more difficult to approach and understand only points to the need of the best methods of classification.

[1] Pintner, R., "The Value of Mental Tests in the Classification of Pupils," *American Annals of the Deaf*, Vol. LXIII, No. 2, March 1918, pp. 196-204.
[2] Best, H., *op. cit.*, Chapter XX, p. 298.

CHAPTER VIII

Effect of Deaf and Hearing Pupils Being in the Same School

In several schools visited, especially public day schools, there were found various types of hearing children, scattered among the deaf. In one or two cases the deaf classes were in reality the place where any kind of mental defective seemed to be deposited. This policy seems unfair for two reasons, first because it lowers the standard of the deaf work, and second, because the mental defective takes an undue amount of attention which might more profitably be spent on the child who is lacking simply in the one sense.

At least one school was found, in which about fifty percent of the student body was composed of hearing children. Some few children had speech defects and others showed apparently no perceptible reason for being placed in this school and classified as deaf children. The influence of these children in their association with the deaf children may be a good thing, just as a deaf class in a public hearing school has proved satisfactory in making the children more adaptable when thrown with speaking and hearing people. It would certainly be unfair, however, to require deaf children to maintain the same standard as their hearing classmates.

We have not included such hearing children in our standardization of tests for the deaf, because the results of such hearing children would influence the norms for the deaf, making them too high and thus automatically lower the rating for deaf children. Furthermore, in the comparison of schools, the rating of hearing children, who appear in deaf schools, according to the deaf norms, would cause the median for the whole school to be higher in proportion to the number of hearing children in a given school. This is shown to a marked degree in the school which we have selected for discussion.

Just fifty percent of the tests made in this school were thrown

out of the standardization because of the children having too much hearing to be classified as deaf. The remaining fifty per-cent gave a median mental index for the whole school of 53, and a median educational index of 55; both of these indices being quite good.

The discarded group of children, if judged according to the deaf norms, have a median mental index of 57 and a median educational index of 75. The mental index in this case is rather high, but the educational index is entirely out of proportion. This high educational index of 75 is, of course, due to the fact that we are comparing hearing, speaking children with norms based upon the educational performance of deaf children. It is to be expected that hearing children would do much better on the educational tests than deaf children, and so this group gets a high median educational index.

These same children, graded according to hearing standards, show medians more nearly according to expectation. The median mental index is 51 while the educational index drops to 45. This indicates that these hearing children found in this public deaf school would be classified as of average intelligence if they had been tested in a hearing school. Similarly their educational performance, when compared with hearing children, drops from 75 to 45. This educational index of 45 further shows that they are not accomplishing what they should do, having a mental index of 51. Note, therefore, the discrepancy. If they are judged according to the deaf norms, their educational achievement (75) is far above their mental achievement (57), and we should consider them doing excellent work. Rate them, however, as they should be rated, namely as hearing children, and we see that their educational achievement (45) is below their mental ability (51). By placing them with deaf children, we are doing them an injustice in as much as we are not giving them as much educational work as they are entitled to.

Putting the two groups together, all being graded according to the deaf norms, we have a median mental index for the whole school of 55 and an educational index of 66. Such indices would put the school among the highest ranking schools, that is, the

children would be ranked as of high average intelligence, doing unusually fine educational work. This is due to the fact that the hearing children raise the educational index disproportionately. Without these hearing children the mental index of the school is 53 and the educational only 55. The inclusion of hearing children, rated as deaf in deaf schools, will give a false impression of the quality of the educational attainment of the group. The indices for the deaf children alone, namely 53 and 55, are more nearly what we would expect from a public day school of this size. The indices will be nearer to average, or 50, the larger the school. Only when we have a small group of superior children do we find indices much above 50.

If we had graded all the children in this school according to the standard for the deaf, this school would have ranked with the five highest mentally and at the very top educationally. Such a rank for this school, where there are so many hearing children, would be entirely unfair to the other schools, where the student body is more uniformly deaf.

The policy of including a great many hearing children in an avowedly deaf school is unquestionably bad. In the case in question, the mentality of these hearing children was average. The instruction, however, was admittedly adapted to the deaf. The hearing children were therefore suffering from a lack of sufficient educational stimulus as shown by the test. They were being deprived of educational opportunities that were rightly theirs. And the school as a whole, posing as a school for the deaf, gave the impression of accomplishing a great deal educationally as judged by the standards of ordinary deaf schools. Here is evidence for the need of more uniform classification of deaf schools throughout the country.

CHAPTER IX

A Comparison of Orally and Manually Taught Pupils

From the beginning of the public instruction of the deaf there has been continual contention between the oralists and the advocates of the manual method. For the most part the arguments have been based purely on theory with very few facts to substantiate the contentions. Binet and Simon[1] made a rough investigation of the results obtained from the two methods by using a questionnaire. Their cases were, perhaps, rather too selected and the number too small. They conclude that the oral method is an absolute failure with at least one-third of deaf children; also that, for the most part, the oral method is usable only with partially deaf children and those losing their hearing after three years of age. Even a large percentage of these fail to make use of speech or lip-reading in their relations with hearing people. They advocate the use of a combination of both the methods; the oral method for improving their use of grammatical English and the manual method for acquiring facts.

Pintner and Paterson[2] in an experiment, testing the visual memory span, find that the oral pupils consistently show a higher average number of digits remembered, at each age than the manually taught pupils. The average memory span for the oral pupils increases regularly from age seven to age fourteen, then remains the same up to age sixteen, when another increase is made, which remains constant up to adults.

The average span for the manual pupils increases regularly from age eight to age twelve, but from then on becomes very irregular. Age thirteen for the manual pupils is the only one which shows a memory span of four digits while for the oral pupils, ages fourteen, fifteen, sixteen, seventeen, eighteen and

[1] Binet et Simon, *op. cit.*

[2] Pintner, R., and Paterson, D. G., "A Comparison of Deaf and Hearing children in Visual Memory for Digits," *Journal of Experimental Psychology,* Vol II, No. 1, February 1917, pp. 76-88.

adults show an average memory span of over four digits. These digits were presented visually and the children reproduced them in writing so that speech and language ability were not interfering factors.

The conclusion drawn is rather that the duller pupils are put in the manual classes and that the duller pupils, on the whole, have the poorest memories. This policy certainly seems to be the one used in schools where both the oral and manual methods prevail.

From an unpublished work by the same authors on the results of Performance Scale tests with the deaf the following quotation is taken: "In this comparison of the oral and manual pupils on the nine tests we see, in general, the superiority of the oral over the manual. This superiority is not evident at every age in every test, but it is seen in the majority of age groups on all the tests. Again in almost every test the manuals show a greater variation within the age group than the orals. This would indicate that the manual pupils are not as homogeneous as the orals. In the selection of the better pupils for the oral instruction some of the mentally bright are evidently overlooked and are left in the manual classes along with the dullest groups of children in the school. We have also noticed that in every test the increase in ability from age to age, though apparent, is not absolutely constant. Every now and again we have age groups older chronologically showing inferior performances to younger age groups. Some of this is due to the relatively small number of cases at each age. We shall see later that much of this irregularity disappears when we combine the results for both oral and manual pupils. This irregularity in the medians and percentiles is most marked at the upper ages, and in these ages some of the irregularity is doubtless due to the fact that there is a tendency for the duller pupils to remain in school. The upper ages contain relatively fewer bright pupils. The bright pupil will complete his school work faster than the dull pupil and therefore tend to leave school at an earlier age."

Also from the results of tests made on the Seguin Form Board the writers find that—"on the whole the orals are superior to the

manuals on this test, but that this superiority is not marked at every age, indicating that the abilities of the orals and manuals in each age group is not very uniform. The lack of uniformity is due to the fluctuations of the abilities in the manual age groups. This is shown by the greater irregularity of the whole curve for the manual pupils, as contrasted with the greater regularity of the curve for the orals." And again, "61.6 percent of orals surpass the median for the manuals." On the Digit-Symbol and Symbol-Digit tests the writers[3] found the same irregularity of median scores from age to age with the manual pupils and the consistent inferiority of scores as contrasted with the median age scores for the oral pupils.

The Trabue tests[4] given in four schools show the oral pupils doing better language work than the manual pupils, even when the test is written, and with much the same type of problem as that used in the class room for language drill.

In another article[5] the oral and manual pupils do not show any marked difference in ability to comprehend and carry out the directions in the Woodworth and Wells Easy Directions Test up to the age of fourteen, but from there on the oral pupils are markedly superior. This may be because the duller pupils have been sifted out of the oral classes by that age.

Taylor[6] found, after having the children write as many words as they could think of in fifteen minutes that there was no difference in the spelling ability of the oral and manual groups, although at first there appeared to be a difference in favor of the manuals. This apparent difference disappeared, however, when he learned that the manuals on the average were considerably older than the oral pupils. The fact that manual pupils often

[3] Pintner, R., and Paterson, D. G., "Learning Tests with Deaf Children," *Psychological Review Monograph,* Vol. XX, No. 4, February 1916, whole No. 88.

[4] Pintner, R., and Paterson, D. G., "A Measurement of the Language Ability of Deaf Children," *Psychological Review,* Vol. XXIII, No. 6, November, 1916, pp. 413-436.

[5] Pintner, R., and Paterson, D. G., "Ability of Deaf and Hearing Children to Follow Printed Directions," *Pedagogical Seminary,* Vol. XXIII, December, 1916, pp. 477-497.

[6] Taylor, H., "A Spelling Test," *American Annals of the Deaf,* Vol. XLII, 1897, pp. 364-369.

have an added aid to memory in finger spelling, seems to give no advantage.

TABLE 17

Distribution on the Non-lanuage Test according to Oral, Manual and Combined Methods

Index	Oral		Manual		Combined		Manual and Combined		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%
0- 9	6	0.3	3	1.4	1	0.8	4	1.2	10	0.4
10- 19	14	0.8	14	6.6		.4	14	4.1	28	1.3
20- 29	99	5.6	28	13.3	3	2.4	31	9.2	130	6.2
30- 39	264	15.1	40	18.9	10	8.0	50	15.7	314	15.0
40- 49	439	25.1	55	26.0	34	27.2	89	27.9	528	25.2
50- 59	453	25.8	39	18.5	35	28.1	74	23.1	527	25.2
60- 69	325	18.5	19	9.0	24	19.4	43	12.7	368	17.6
70- 79	124	7.1	11	5.2	10	8.0	21	6.2	145	6.8
80- 89	18	1.0	2	0.9	4	3.2	6	1.7	24	1.1
90-100	11	0.6			3	2.4	3	0.9	14	0.7
Total	1753	99.9	211	99.8	124	99.5	335	102.7	2088	99.5
Median	51		43		54.5		48		50	

TABLE 18

Distribution on the Educational Test according to Oral, Manual and Combined Methods

Index	Oral		Manual		Combined		Manual and Combined		Totals	
	No.	%	No.	%	No.	%	No.	%	No.	%
0- 9	7	0.4	1	0.4			1	0.3	8	0.3
10- 19	22	1.2	5	2.4			5	1.5	27	1.2
20- 29	95	5.4	29	13.8	1	0.8	30	8.0	125	5.9
30- 39	268	15.3	50	23.7	23	18.5	73	22.8	341	16.3
40- 49	418	23.8	57	27.0	33	26.3	90	28.1	508	24.3
50- 59	449	25.6	44	20.8	30	24.1	74	23.1	523	25.0
60- 69	320	18.3	20	9.4	21	16.9	41	12.2	361	17.2
70- 79	140	8.0	4	1.8	13	10.4	17	5.0	157	7.5
80- 89	23	1.3	1	0.4	1	0.8	2	0.5	25	1.1
90-100	11	0.6			2	1.6	2	0.5	13	0.6
Total	1753	99.9	211	99.7	124	99.4	335	102.0	2088	99.4
Median	51		42		50.5		45		50	

An attempt has been made to establish some facts on this subject from results of the present survey. Tables 17 and 18 give the results of the Non-language and of the Educational Tests, distributed into ten groups. In Table 17 we have the distribution on the mental test of the oral pupils, in the first column. The second column gives the percentages of the same. The next two columns show actual numbers and percents for

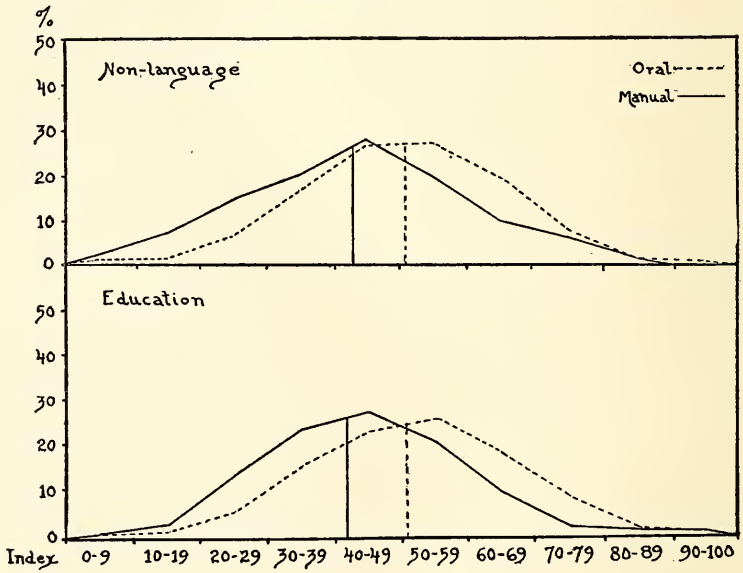
the manual pupils. The third group shows the number and percentage distribution of the pupils taught according to a combination of the two methods. The fourth group gives the distribution of all pupils other than pure orals and the final columns show the totals. The horizontal line at the bottom of the table gives the medians for the different groups.

Table 18 shows the same kind of a distribution of the results on the Educational Test, that is oral, manual, combined, combined plus manual, and totals. The median indices are found in the bottom horizontal line.

These results seem to suggest several important conclusions. Let us first restrict our attention to the two groups of oral and manual pupils. Both the frequency curves, Graph V, and the

GRAPH V

Distribution of Oral and Manual Pupils on the Non-language and Education Test



medians show that the manual group is slightly inferior in mental make-up. The percentages of manual pupils are larger than the percentages of oral pupils for the first five divisions of the frequency Table 17, and the reverse holds true for the five

higher divisions of the table. There are no manual pupils at all in the highest group (index above 90). The median of the manual pupils is 43 or eight points below the median of the oral pupils, which is 51. These results show, therefore, what practically every other mental test has shown, namely, that consciously or unconsciously there is a discrimination against the mentally inferior deaf child going on in schools where both oral and manual classes are maintained. The mentally slow tend to be placed in the manual classes. This is the openly acknowledged principle in some schools. Our table of distribution, however, shows us further that, in spite of this unconscious principle, a fair proportion of bright and average deaf children are assigned to manual classes. For example we note that 15.1 percent of the manual pupils would be classed as above average mentally (*i.e.* all having indices above 60). The fact that these pupils are in manual classes is due to several factors, such as: definite choice of manual instruction on the part of the child or parents, lack of ability of teachers or superintendents to diagnose adequately mental ability, special but as yet unrecognized disabilities of certain children to learn speech and lip-reading. The latter factor is not recognized by the pure oralist and is a mere hypothesis on our part. At any rate these factors or similar ones lead to the interesting result that we find a fair sampling of children of all degrees of mentality among manual pupils with a greater preponderance of duller pupils. Combining the percentages of oral and manual into the five groups so that we may compare them better, we get the following comparison:

	V. Br.	Br.	N.	B.	D.
Oral	1.6	25.6	50.9	20.7	1.1
Manual	0.9	14.2	44.5	32.2	8.0

This brings out clearly the almost normal distribution of the oral and the skewed grouping of the manual, showing at the same time, however, a scattering of bright and very bright among the manual.

If we now turn to the distribution on the educational tests we find a very similar distribution. The median for the manual is 42, or nine points below the median for the oral. The shape of both curves resembles the shape of the curves for the mental

test. A comparison of the oral and manual into five groups shows the following distribution for educational ability:

	V. G.	G.	A.	P.	V. P.
Oral	1.9	26.3	49.4	20.7	1.6
Manual	0.4	11.2	47.8	37.5	2.8

Again we note an almost normal curve for the oral and a skewed grouping for the manual.

We are now ready to raise the question as to whether each group is doing as much educationally as they should do, considering their mental ability. Taking the oral pupils first we note that the median mental index is 51 and the median educational index is also 51, so that as a group they are coming up to expectation. To see if this is also true of the distribution in general we can compare the five groups on the two tests as follows:

	V.B.&V.G.	Br. & G.	N. & A.	B. & P.	D. & V.P.
Mental	1.6	25.6	50.9	20.7	1.1
Educational ...	1.9	26.3	49.4	20.7	1.6

There are about the same number accomplishing very good work as there are very bright pupils mentally. There is 1.3 percent more doing good educational work than are diagnosed bright, so that the showing here is good. By comparing the percentages of normal and average we note that the excess percentage in the previous column now shows itself in a slightly lower percentage of average educationally as compared with mentally normal. The next column shows identical percentages, and the last column practically identical. To sum up then, we may say that oral pupils as a group accomplish educationally what is to be expected of them. We must not forget, of course, that our norms for the deaf as a whole are largely determined by oral pupils, because they make up 1753 out of the total of 2172 cases used in the standardization. This does not vitiate the type of comparison we are making here.

Turning to the manual pupils, we note that the median educational index is 42 or one point below the median mental index. The difference between these medians is very slight and practically negligible. Comparing the five groups on the two tests we have the following:

	V.B.&V.G.	Br. & G.	N. & A.	B. & P.	D. & V.P.
Mental	0.9	14.2	44.5	32.2	8.0
Educational ...	0.4	11.2	47.8	37.5	2.8

The percentage of very bright and very good pupils is about the same. The percentage of good pupils is 3 percent lower than that of the bright pupils. Evidently we see here a tendency for pupils bright mentally not to accomplish as much as they should educationally. The manual method or its teachers fail to a slight degree to make use of all the mental ability of their bright pupils in the direction of standard educational knowledge. The excess of educationally average over mentally normal is due to the dropping down of bright pupils. The next two columns are interesting. The educational percent in the very poor column is about 5 percent less than in the mental test and this deficiency of 5 percent is taken care of in the poor column. So we must conclude that the manual teachers or methods show a very noticeable tendency to accomplish more educationally with the very dull pupils than is ordinarily the case.

Our general conclusions from this comparison of pure oral and pure manual pupils are:

(A) That each group is on the whole accomplishing what it ought to accomplish in the ordinary school subjects when presented in a written examination, when we take into account the mental caliber of the pupils as tested by Non-language psychological tests.

(B) That the oral method does not, therefore, lead to a better comprehension of the English language as written, or to the comprehension of history, geography and arithmetic. Our results show that manual children of equal mental ability to oral children do just as well as oral pupils in understanding written language and in written responses to language when read. Our investigations do not touch in any sense on speech and lip-reading, but they would seem to imply that time spent on these subjects by oral pupils does not seem to have any additional effect upon their written language and their reading ability that is not also gained by manual pupils by their particular methods of instruction. In psychological terminology we see no indication of additional transfer from speech and lip-reading to reading and writing English, over and above any transfer that may exist from signing and finger spelling to these subjects of instruction.

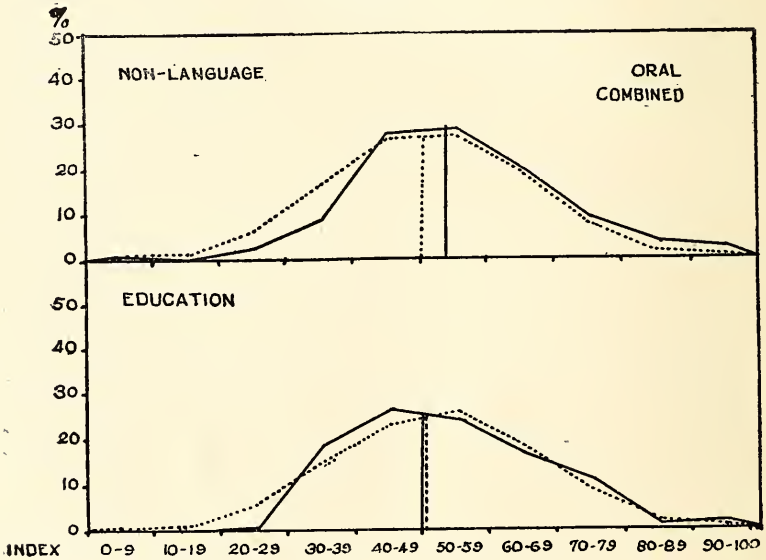
(C) There seems a faint indication that the manual method does not give enough stimulus to its brighter pupils. This may be the fault of the present system, because so few bright pupils are found among the manual pupils and, therefore, such as are there may fail to find adequate intellectual stimulus. Or this condition may be due to poorer teachers or methods of teaching, in the manual department.

(D) There is a perceptible indication that the manual method or its teachers produce better results educationally with the very dullest pupils. This may be due to the method, whereby more time can be given to simple language work, because time need not be spent on speech and lip-reading. Or this may be due to more competent teachers in charge of the very dull, or to the fact that the manual method is more suitable for the dull pupils.

Graph VI shows the curves of the pure orals and the group marked combined method. This latter represents a small group of children who have had and make use of both oral and manual methods. Looking at the Non-language curves we find this

GRAPH VI

Distribution of Oral and Combined Pupils on the Non-language and Education Test



group showing a higher percentage of pupils in the brighter groups and a smaller percentage in the lower groups. Comparing the five groups we have:

	V. Br.	Br.	N.	B.	D.
Oral	1.6	25.6	50.9	20.7	1.1
Combined	5.6	27.4	55.3	10.4	.8

A difference of 4 percent in the very bright group, 1.8 percent in the bright group, 4.4 percent in the normal group, and 10.3 percent in the backward group are rather large differences. The dull group with a difference of 0.3 percent is the only one which shows a negligible difference. These differences as well as the median for the group which is 3.5 points above that for the oral group would indicate that this is a rather mentally superior group of children.

The educational curve does not make such a good showing, since the combined curve is skewed to the left and the median drops half a point below that for the oral group. Comparing the five groups on the education tests we have:

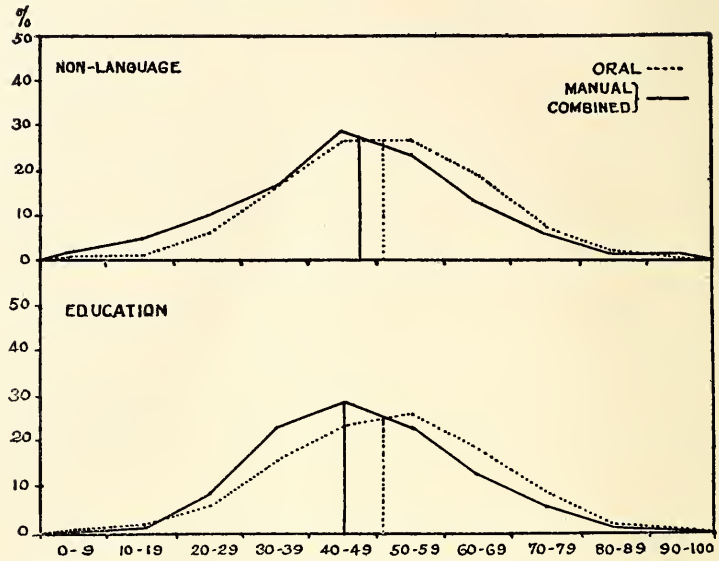
	V. G.	G.	A.	P.	V. P.
Oral	1.9	26.3	49.4	20.7	1.6
Combined	2.4	27.3	50.4	19.3	0.0

The combined group shows a higher percentage of pupils in the very good, good and average groups and lower in the poor group, with none in the very poor group, but in none of the groups are the differences so marked as in the case of the mental test. This group of children seems to be doing slightly poorer educational work than we might expect of such mental ability. Has the change from one school or method to another tended to slow them up educationally? We think not, although this may have had some influence.

A further factor entering into this consideration of the combined group is the fact that the group itself is small and contains a certain number of older pupils and college students. These latter as a rule have good mental ratings, but their educational ratings are often somewhat lower than their mental ratings owing to the fact that the educational test is not so well adapted to them as it is to other school children. The educational test does not call for the type of work done in college and, therefore, is not as good a measure of this attainment.

GRAPH VII

Distribution of Oral, Manual and Combined Pupils on the Non-language and Education Test



Graph VII gives the curve for the oral group compared with a curve for the pure manual and combined groups. Here we have curves very similar to those of the pure oral and manual groups.

	V. Br.	Br.	N.	B.	D.
Oral	1.6	25.6	50.9	20.7	1.1
Manual and Comb'd	2.6	18.9	51.0	24.9	5.3

The differences show the manual and combined groups with 1 percent more very bright pupils than the oral group. The oral group has quite a preponderance of bright pupils over the manual and combined, that is 6.7 percent more. The normal groups are practically the same, while the manual and combined groups show 4.2 percent more backward and 4.2 percent more dull pupils than the oral group.

The educational comparisons are:

	V. G.	G.	A.	P.	V. P.
Oral	1.9	26.3	49.4	20.7	1.6
Manual and Comb'd	1.0	17.2	51.2	30.8	1.8

These differences show the oral group with 0.9 percent more pupils doing very good educational work even though the manual

and combined group have a majority of very bright pupils. The orals show 9.1 percent more doing good work. This is even better than was found on the mental test. The manual and combined group have a slight advantage of 1.8 percent in the average group, while they were about the same on the mental test. The manual and combined groups show a difference of 10.1 percent more cases in the poor group than the orals, while again in the very poor group the difference is negligible.

We see that while this combined group are superior children mentally, they are somewhat below the pure oral group educationally, so that when they are added to the pure manuals the curves are very similar to the first graph.

CHAPTER X

Degree of Deafness and Age of Onset

The superiority of the adventitiously deaf child, who has lost his hearing several years after birth, has been pretty well established, so far as ability in language is concerned, by former experiments.

Pintner and Paterson[1] found in the Visual Memory test that the age of becoming deaf greatly influenced their results. "The average efficiency tends to increase with the number of years of auditory experience prior to becoming deaf."

On the Symbol-Digit and Digit-Symbol tests[2] the difference in the median for each age, for the congenitally and adventitiously deaf are so nearly the same that we can not say that there is any difference between the two groups. On the other hand, in measuring the ability to follow printed directions, Pintner and Paterson[3] found children becoming deaf later in life showing better comprehension of language and ability to respond correctly.

After the giving of the Trabue Language Completion test[4] the conclusion was reached that children who lost their hearing before the age of four or five derived very little benefit from having once heard, when it is a question of understanding and using language. Those children becoming deaf later in life show much greater ability in language.

A more extreme statement is that drawn from the 1910 Government Census Report,[5] that children losing their hearing anywhere up to eight years of age were classed as deaf and considered as not having any advantage over those "born deaf."

A great deal of the language difficulty of the deaf is due to the very slow and painful means of acquiring a vocabulary

[1] Pintner, R., and Paterson, D. G., *op. cit.*
[2] Pintner, R., and Paterson, D. G., *op. cit.*
[3] Pintner, R., and Paterson, D. G., *op. cit.*
[4] Pintner, R., and Paterson, D. G., *op. cit.*
[5] Deaf Mutes in the United States. Analysis of the Census of 1910. *American Annals of the Deaf,* Vol. LXII, No. 1, January 1917, pp. 62-82.

which the hearing child almost unconsciously absorbs from his environment of speaking people. Therefore, the deaf person has an extremely limited vehicle for expressing his ideas. Having acquired even a small part of this vocabulary before becoming deaf certainly would throw some advantage to the side of the adventitiously deaf child.

Weaver[6], in a paper read before a Teachers' Association of the Pennsylvania Institution for the Deaf and Dumb, points out that the congenitally deaf child, on entering school, has not reached the point where language begins to interpret language, that is, he does not benefit from the printed page because he does not think in language. He must be taught to classify, associate, compare and contrast, in other words to discern relationships. He cannot get the meaning from the context.

Love,[7] in his extensive studies of the deaf, found a much smaller percentage of congenitally than adventitiously deaf. Our results do not agree with this finding, since we have 116 more congenital than adventitious, if we count the "unknown" with the latter. This group designated "unknown" are children about whose deafness there was no record. At least the schools had no record of the age at which they had become deaf. They seem to resemble the congenital group very much in ability. This fact has been observed by Pintner in all his experiments and is corroborated by R. O. Johnson[8] when he says that probably two-thirds of the cases marked "unknown," are really congenital cases. Our results bear this out both for the Non-language and Educational tests, since the median indices for the "Unknown" group are practically the same as for the congenital group.

Table 19 gives a distribution of the congenital cases on the Non-language test, according to age. In each age group the totally and partially deaf are given separately. From the medians found at the bottom of the table we find the congenitally totally deaf showing a higher median at ages 8, 9, 14, 16, and

[6] Weaver, J. A., Paper read at Teachers' Association of Penn. Institution, *American Annals of the Deaf*, Vol. LXIII, No. 5, November 1918, pp. 407-415.

[7] Love, J. K., *op. cit.*

[8] Johnson, R. O., "Some Statistics Concerning the Deaf," Bulletin issued by the Indiana State School for the Deaf, 1916, p. 14.

19. In all other ages the congenitally partially deaf have the higher medians. The entire congenital group separated into total and partial show medians of 48.5 and 49, respectively, while all congenitals together have a median mental index of 48.5. This would seem to indicate that a congenitally deaf child does not profit at all from his slight hearing as far as development of general intelligence is concerned.

Table 20 gives the same kind of a distribution of the congenital cases on the educational test. On examination of the medians in this case we find the total and partial groups having the same median at age eight. At ages 9, 10, 11, 14, and 17 the congenitally total groups have the higher medians, while at all other ages the partially deaf have the higher medians. The congenitally totals of all ages have a median of 46.5 while the congenitally partials have a median of 49.5. The whole congenital group has a median educational index of 47.5. This difference is just what we might expect in educational attainment if the teacher makes use of the residual hearing. Whether more use of this residual hearing could be made and thereby increase educational attainment is a question to be raised.

The conclusion to be drawn is that the slight degree of hearing which a congenitally deaf child may possess gives him no consistent advantage educationally, from age to age, but on the whole the congenitally partially deaf child has a slight advantage over the totally deaf individual. Also the congenital group as a whole is not attaining educationally quite as high a median as they are mentally.

The curves in Figure J give us a picture of the distribution of the total and partial groups on the two test series. On the mental test we find the curves almost exactly overlapping, showing no superiority of the partially deaf, except what might be accounted for by chance. On the educational test there is not the same correspondence, but the curves cross and recross so that we do note a little superioriy of the partially deaf.

Table 21 gives a distribution of the non-language test, according to the age of becoming deaf of the adventitious cases. The first column gives the indices; the second column, the distribution

20 C.T.	20 C.P.	21+ C.T.	21+ C.P.	Total C.T.	%	Total C.P.	%	Total
	1	1		20	2.0	3	1.0	23
5		8	3	206	24.0	56	23.0	262
8	4	11	5	437	51.0	118	49.0	555
	1	1	1	187	22.0	59	25.0	246
				12	1.0	4	2.0	16
13	6	21	9	862	100.0	240	100.0	1102
43	53.5	44	49	48.5		49		48.5
19		30						
51		47						

20 C.T.	20 C.P.	21+ C.T.	21+ C.P	Total C.T.	%	Total C.P.	%	Total
1		1		17	2.0	3	1.0	20
5	1	10	2	230	27.0	60	25.0	290
7	4	10	7	441	51.0	111	46.0	552
	1			170	20.0	63	26.0	233
				4		3	1.0	7
13	6	21	9	862	100.0	240	99.0	1102
40	50.5	38	47	46.5		49.5		47.5
19		30						
45		44						

Index	13 A.P.	14 A.T.	14 A.P.	15 A.T.	15 A.P.	Unknown A.T.	Unknown A.P.	Total A.T.	%	Total A.P.	%
0- 19						3		14	2.0	1	0.0
20- 3			1			13	6	124	18.0	58	19.0
40- 5	2	2				26	9	340	49.0	160	53.0
60- 7	1			2		12	4	196	28.0	75	25.0
80-10						1		14	2.0	4	1.0
Total	3	2	1	2		55	19	688	99.0	298	99.0
Median	55	48	36	65.5		47	51	51.5		50	
Total	5	3		2		74					
Median	55	43		65.5		48					

19. In all other ages the congenitally partially deaf have the higher medians. The entire congenital group separated into total and partial show medians of 48.5 and 49, respectively, while all congenitals together have a median mental index of 48.5. This would seem to indicate that a congenitally deaf child does not profit at all from his slight hearing as far as development of general intelligence is concerned.

Table 20 gives the same kind of a distribution of the congenital cases on the educational test. On examination of the medians in this case we find the total and partial groups having the same median at age eight. At ages 9, 10, 11, 14, and 17 the congenitally total groups have the higher medians, while at all other ages the partially deaf have the higher medians. The congenitally totals of all ages have a median of 46.5 while the congenitally partials have a median of 49.5. The whole congenital group has a median educational index of 47.5. This difference is just what we might expect in educational attainment if the teacher makes use of the residual hearing. Whether more use of this residual hearing could be made and thereby increase educational attainment is a question to be raised.

The conclusion to be drawn is that the slight degree of hearing which a congenitally deaf child may possess gives him no consistent advantage educationally, from age to age, but on the whole the congenitally partially deaf child has a slight advantage over the totally deaf individual. Also the congenital group as a whole is not attaining educationally quite as high a median as they are mentally.

The curves in Figure J give us a picture of the distribution of the total and partial groups on the two test series. On the mental test we find the curves almost exactly overlapping, showing no superiority of the partially deaf, except what might be accounted for by chance. On the educational test there is not the same correspondence, but the curves cross and recross so that we do note a little superioriy of the partially deaf.

Table 21 gives a distribution of the non-language test, according to the age of becoming deaf of the adventitious cases. The first column gives the indices; the second column, the distribution

TABLE 19
Distribution of Congenitally Deaf on the Non-language Test
According to Total or Partial Deafness

Index	Age 8 C.T.	8 C.P.	9 C.T.	9 C.P.	10 C.T.	10 C.P.	11 C.T.	11 C.P.	12 C.T.	12 C.P.	13 C.T.	13 C.P.	14 C.T.	14 C.P.	15 C.T.	15 C.P.	16 C.T.	16 C.P.	17 C.T.	17 C.P.	18 C.T.	18 C.P.	19 C.T.	19 C.P.	20 C.T.	20 C.P.	21+ C.T.	21+ C.P.	Total C.T.	%	Total C.P.	%	Total
0- 19					1	1	3		2		2		3		4		1		1		1		2		1		1		20	2.0	3	1.0	23
20- 39		3	5	1	8	3	15	5	21	5	30	8	29	8	30	5	19	8	11	3	14	2	11	2	5	8	3		206	21.0	56	23.0	262
40- 59	7	3	12	6	21	14	35	8	56	12	56	18	69	15	50	14	41	5	34	10	24	3	13	1	8	4	11	5	437	51.0	118	49.0	555
60- 79	1	1	8	3	8	7	23	4	19	5	17	13	34	4	32	9	18	4	7	5	9	1	10	1		1	1	1	187	22.0	59	25.0	246
80-100			1		1		1	2	2		2	1	1		2		1		1		1								12	1.0	4	2.0	16
Total	8	7	26	10	38	26	77	19	100	22	107	40	136	27	118	28	80	17	54	18	48	7	36	4	13	6	21	9	862	100.0	240	100.0	1102
Median	51	42	52.5	47	48.5	51.5	52	53	49.5	51	46	55	52	42	47.5	54	47.5	42	48	51	48.5	50	50	42	43	53.5	44	49	48.5		49		48.5
Total	15		36		64		96		122		147		163		146		97		72		55		40		19		30						
Median	44		49		50		52		50		49.5		48		49.5		45		50		48.5		46		51		47						

TABLE 20
Distribution of the Congenitally Deaf on Education Test
According to Total or Partial Deafness

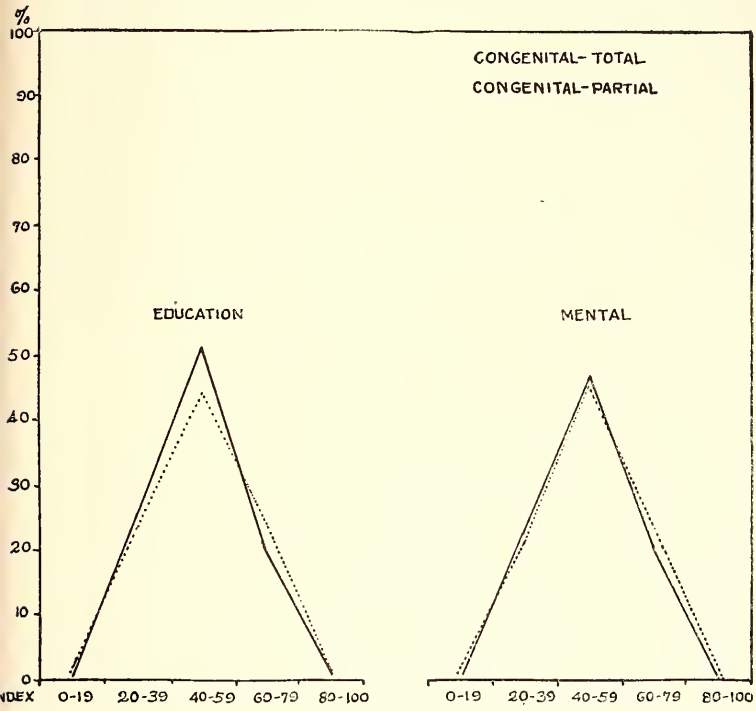
Index	Age 8 C.T.	8 C.P.	9 C.T.	9 C.P.	10 C.T.	10 C.P.	11 C.T.	11 C.P.	12 C.T.	12 C.P.	13 C.T.	13 C.P.	14 C.T.	14 C.P.	15 C.T.	15 C.P.	16 C.T.	16 C.P.	17 C.T.	17 C.P.	18 C.T.	18 C.P.	19 C.T.	19 C.P.	20 C.T.	20 C.P.	21+ C.T.	21+ C.P.	Total C.T.	%	Total C.P.	%	Total
0- 19									1		2	1	5	1	4		1		2				1		1		1		17	2.0	3	1.0	20
20- 39	3	3	10	2	10	6	18	3	27	5	31	8	25	8	31	8	25	4	12	7	10	2	13	1	5	1	10	2	230	27.0	60	25.0	290
40- 59	4	1	9	6	18	15	36	13	52	10	61	11	76	12	54	11	38	7	33	8	29	3	14	3	7	4	10	7	441	51.0	111	46.0	552
60- 79	1	2	7	2	10	5	23	3	19	7	11	20	29	6	29	8	17	4	7	3	9	2	8			1			170	20.0	63	26.0	233
80-100		1							1		2		1		1			1											4		3	1.0	7
Total	8	7	26	10	38	26	77	19	100	22	107	40	136	27	118	28	80	17	54	18	48	7	36	4	13	6	21	9	862	100.0	240	99.0	1102
Median	51	51	46	48.5	48	47	50	47	48	52	49	57.5	48	43	47	50.5	49	54	47	45.5	46	49	47.5	52.5	40	50.5	38	47	46.5		49.5		47.5
Total	15		36		64		96		122		147		163		146		97		72		55		40		19		30						
Median	51		46		48		49.5		50		49		47		48.5		52		46		46.5		51		45		44						

TABLE 21
Distribution on the Non-language Survey According to Age of
Becoming Deaf

Index	Age 0-1 A.T.	0-1 A.P.	1-2 A.T.	1-2 A.P.	2 A.T.	2 A.P.	3 A.T.	3 A.P.	4 A.T.	4 A.P.	5 A.T.	5 A.P.	6 A.T.	6 A.P.	7 A.T.	7 A.P.	8 A.T.	8 A.P.	9 A.T.	9 A.P.	10 A.T.	10 A.P.	11 A.T.	11 A.P.	12 A.T.	12 A.P.	13 A.T.	13 A.P.	14 A.T.	14 A.P.	15 A.T.	15 A.P.	Unknown A.T.	Unknown A.P.	Total A.T.	%	Total A.P.	%	Total
0- 19	7	1	3				1																										3		14	2.0	1	0.0	15
20- 39	32	15	15	4	23	12	21	6	4	4	7	1	3	1	2	2	1	1			1	1	1	1	1	3			1				13	6	124	18.0	58	19.0	182
40- 59	88	35	41	11	61	34	41	26	24	13	14	10	12	4	14	6	6	4	1	4	4		2	1	3	1	1	2	2				26	9	340	49.0	160	53.0	500
60- 79	35	19	26	4	44	16	24	12	13	4	8	6	9		9	6	5	1	1		3				2	2	1	1			2		12	4	196	28.0	75	25.0	271
80-100	1	2	2	1	3		2		1				3	1			1																1		14	2.0	4	1.0	18
Total	163	72	87	20	131	62	89	44	41	21	30	17	27	6	25	14	13	6	2	4	8	1	5	2	6	6	2	3	2	1	2		55	19	688	99.0	298	99.0	986
Median	49	53	51	51.5	52	51	53	50	54	55	53	56	55	52	52	50.5	59	51	61	53	55.5	23	58	43	47.5	44	53	55	48	36	65.5		47	51	51.5		50		51
Total	235		107		103		133		62		47		33		39		19		6		9		7		12		5		3		2		71					
Median	50		51		51		52		54.5		54		53		52		55		53		55		54		47.5		55		43		65.5		48					

FIGURE J

Distribution of the Congenital Cases in Total and Partial Groups on the Non-language and Education Tests



of children becoming deaf at one year or under, according to whether they are totally or partially deaf. Cards marked "deafness occurred in early infancy" were included in this group. The second column includes all cases becoming deaf at 13 months up to and including 23 months; the next column "deafness occurring at two years of age" and so on up to "deafness occurring at 15 years of age." The next column gives the indices of a group of children, marked "unknown" when deafness occurred. The next two columns give the totals for total and partial deafness, and the last column the final total.

The medians for the total and partial acquired deafness also vary in the different ages of becoming deaf as they do for the different chronological ages among the congenitally deaf. Ages

one year and under 13 months to 23 months, four years, five years, thirteen years, and the "unknown" group show the partially deaf to have a higher median index, but combining all ages of acquired deafness in two groups of total and partial, we find the children who have acquired total deafness showing a slightly higher median mental index. But the difference of 1.5 points between the two indices is too slight to indicate any real difference in mental ability.

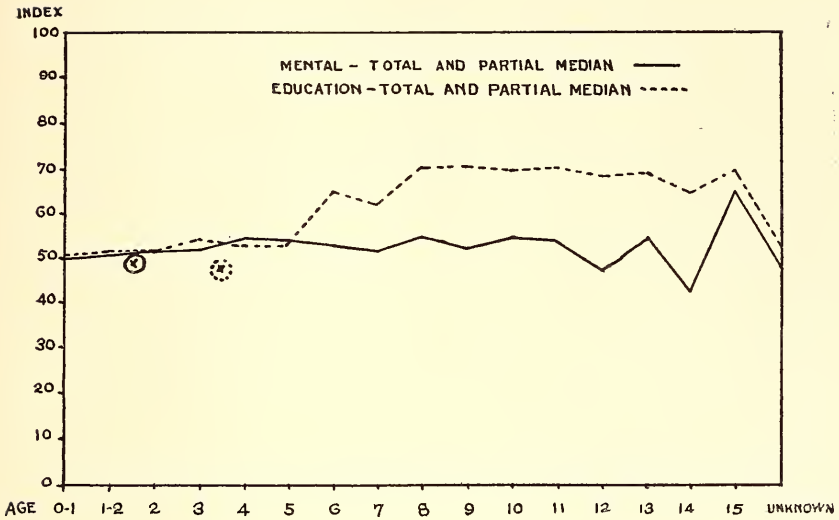
Table 22 gives a similar distribution for the children on the educational test. Here we find age one year and under, thirteen months to twenty-three months, two years, five years, six years, seven years, eleven years, and thirteen years, showing a higher median for the partially deaf than for the totally deaf, among those acquiring deafness. However, the median for the whole group of totally deaf is 55, while for the partially deaf it is 51. The median index for the adventitious group as a whole is 53.

On the Non-language test the medians from age to age cluster about 50, but on the educational test there is a very marked increase in the medians from ages 6 to 15, the "unknown" group again dropping back to a median similar to those for children losing their hearing early in life. Thus, as has been pointed out before, they more nearly resemble the congenitally deaf.

Figure K shows a curve of the medians for each age of adventitious deafness, with the median for the "unknown" group last. The solid line represents the Non-language medians. This practically straight line is just what we would expect, if our tests are a good measure of native ability. The fluctuations towards the end are due to the small number of cases. Acquired deafness would not affect innate ability, unless the cause of deafness was some disease which would bring about some degeneration of the central nervous system.

The dotted line represents the educational medians. Here our results would seem to indicate that having hearing up to the age of five years makes no difference worth mentioning in the educational attainment over native ability. However having had hearing up to the age of six years would seem to cause a decided rise in our curve. Again, at age eight years there is a rise to another level, which is almost smooth up to the age of

FIGURE K
Medians for Each Age of the Total and Partial Group

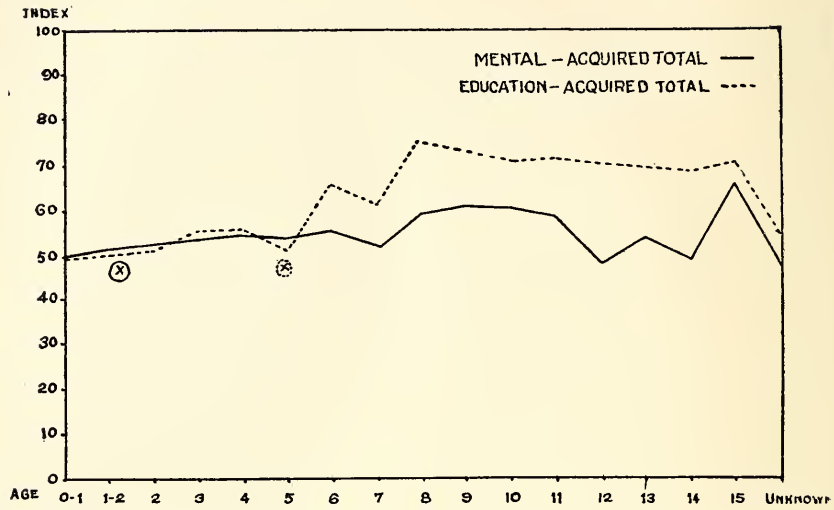


fifteen years. The "unknown" group, coming last in the curve, drops to medians similar to those for children acquiring deafness in very early life. The cross with the broken-line circle around it, indicates the educational median (47.5) for the congenital deaf group. The cross with the solid-line circle indicates the median index (48.5) on the Non-language test for the congenitally deaf. On both series it is to be noticed that the medians for the congenital group are slightly lower than the medians for any age of acquired deafness.

For the curves in Figure L only the totally deaf of the adventitious group were used. In this case the curves are almost identical with those of Figure K with the exception of sightly higher medians for ages eight, nine, and ten. The marked difference between the mental and educational medians again occurs at age six years.

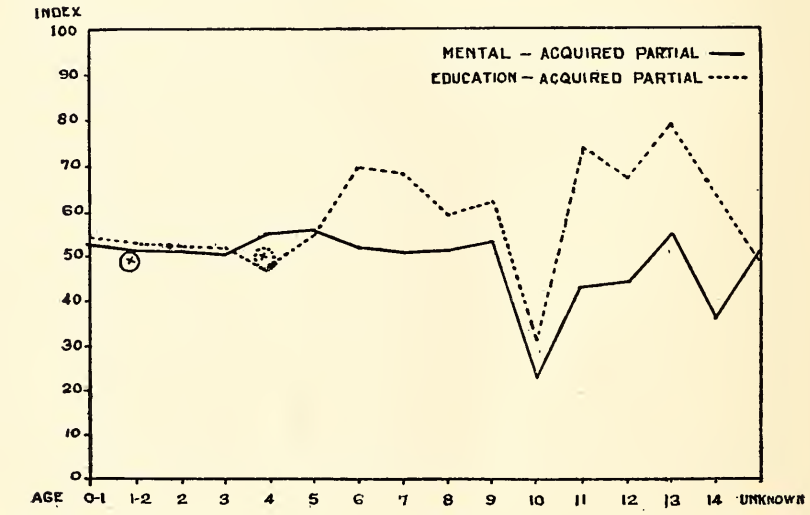
Figure M gives the median for each age acquiring only partial deafness. The marked rise of the educational median here, also comes at age six years. The irregularity of these curves

FIGURE L
Medians for Each Age of Adventitious Deafness



may be due to a fewer number of cases of acquired partial deafness. Also it seems as though partial deafness acquired in

FIGURE M
Medians—Adventitious Partial Deafness



more advanced youth, causes the child to be more confused than when he becomes totally deaf. If partially deaf, he still attempts to adapt himself as a hearing person, while, if he is totally deaf, he must concentrate on adjusting himself to deaf methods of communication. The two crosses within the small circles to the left of the graph are the median mental and educational indices for the congenital groups corresponding with those of each graph. In every case the medians are below those for the adventitious groups. The congenital total medians are somewhat lower than the medians for the congenital partial. Congenital deafness is possibly only one manifestation of a more general inferiority which at the same time causes a lowering of innate ability or general intelligence.

These findings are different from either of those quoted at the beginning of the chapter, in that, we would say, hearing up to the age of six years has significant bearing on the educational attainment of the child. This age is between that set by Pintner, which is age four or five years and that used by the Census Bureau which was age eight.

CHAPTER XI

Sex Differences

Sex differences, so far as differences in mental ability are concerned, do not seem to exist to any great extent. Pintner finds no consistent superiority of either sex among the deaf, either in his experiment on Visual Memory or Learning Tests or Performance Tests. The curves for each sex remained very close together at all ages.

What has been found by several investigators is a preponderance of males among deaf children. Peet[1] found this to be true. Also Fusfeld[2] in the Thirteenth Census of the Deaf, writes that there are 121.5 males to 100 females. Love[3] reports that in eleven countries the number of deaf males exceeds the number of females 5 to 4, although in the population at large there are more girls than boys. According to Love the male deaf do not seem to live as long as the female. Our results show an excess of girls in only four age groups. In all other age groups the males exceed the females and the total ratio shows 117.7 males to 100 females.

Table 23 shows the frequency distribution for both sexes at each age on the Non-language Survey Test. The total number of cases with the median for each age is given at the bottom of the table. At the right of the table are found the total number of males and females with the percentage of each, in the mental groups.

Table 24 shows the frequency distribution for both sexes at each age on the Educational Survey test. The arrangement of this table is the same as that for the Non-language distribution.

Only in two age groups do the girls have a median mental in-

[1] Peet, D., "The Remote and Proximate Causes of Deafness, *American Annals of the Deaf*, Vol. VIII, No. 3, April 1856, pp. 129-158.

[2] Fusfeld, Irving S., "The Deaf in the Thirteenth Census of the United States," *American Annals of the Deaf*, Vol. LXIV, No. 2, March 1918, pp. 87-95.

[3] Love, J. K., "Deaf Mutism," Glasgow, J. MacLehose & Sons, 1896.

13		14		15		Unknown		Total				Total
Γ.	A.P.	A.T.	A.P.	A.T.	A.P.	A.T.	A.P.	A.T.	%	A.P.	%	
						3		12	2.0	3	1.0	15
			1			12	5	122	17.0	54	18.0	176
	1					27	10	345	50.0	134	45.0	479
	1	2		2		13	3	190	28.0	95	32.0	285
	1						1	19	3.0	12	4.0	31
	3	2	1	2		55	19	688	99.0	298	100.0	986
)	79	68	28	70		54	48	55		51		
	5		3		2		74					53
	69		65		70		52.5					

21+		Total		Total		Grand
M.	F.	Male	%	Female	%	Total
	2	18	1.6	20	2.0	38
8	9	201	17.8	243	25.2	444
21	18	571	50.8	484	50.2	1055
13	6	305	27.1	208	21.5	513
2		29	2.5	9	0.9	38
44	35	1124	99.8	964	99.8	2088
52.5	48	51		49		50

21+		Total		Total		
M.	F.	Male	%	Female	%	Total
	2	14	1.2	21	2.1	35
8	9	252	22.4	214	22.1	466
21	18	550	49.8	481	49.8	1031
14	5	286	25.4	232	24.0	518
1	1	22	1.9	16	1.6	38
44	35	1124	100.7	964	99.6	2088
53.5	47	51		50		50

CHAPTER XI

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[3] Love, J. K., "Deaf Mutism," Glasgow, J. MacLehose & Sons, 1896.

TABLE 22
Distribution on the Educational Survey According to the Age of Becoming Deaf

Index	Age 0-1 A.T.	A.P.	1-2 A.T.	A.P.	2 A.T.	A.P.	3 A.T.	A.P.	4 A.T.	A.P.	5 A.T.	A.P.	6 A.T.	A.P.	7 A.T.	A.P.	8 A.T.	A.P.	9 A.T.	A.P.	10 A.T.	A.P.	11 A.T.	A.P.	12 A.T.	A.P.	13 A.T.	A.P.	14 A.T.	A.P.	15 A.T.	A.P.	Unknown A.T.	A.P.	Total A.T.	%	A.P.	%	Total
0- 19	4	1	1	1		1	3								1																		3		12	2.0	3	1.0	15
20- 39	43	15	16	5	27	8	13	9	6	3	3	2	1	1	1	2		1			1			1				1					12	5	122	17.0	54	18.0	176
40- 59	85	36	52	8	75	33	44	19	25	11	15	8	10	1	9	2	2	2		2	1			1		1							27	10	345	50.0	134	45.0	479
60- 79	30	20	18	6	28	18	29	14	10	5	9	6	11	3	12	9	8	3	2	1	6		3	2	5	4	2	1	2		2		13	3	190	28.0	95	32.0	285
80-100	1				1	2		2		2	3	1	5	1	2	1	3			1	1		2		1		1						1		19	3.0	12	4.0	31
Total	163	72	87	20	131	62	89	44	41	21	30	17	27	6	25	14	13	6	2	4	8	1	5	2	6	6	2	3	2	1	2		55	19	688	99.0	298	100.0	986
Median	49	54	50	53	51	52	54	52	55	48	51.5	55	65	70	61	68	75	59	73.5	62	71	31	71	74	70	67.5	69	79	68	28	70		54	48	55		51		
Total	235		107		193		133		62		47		33		39		19		6		9		7		12		5		3		2		74						53
Median	51		52		52		54		53		53		65		62		71		71.5		70		71		68.5		69		65		70		52.5						

TABLE 23
Distribution on the Non-language Survey Test According to Sex

	Age 8 M.	F.	9 M.	F.	10 M.	F.	11 M.	F.	12 M.	F.	13 M.	F.	14 M.	F.	15 M.	F.	16 M.	F.	17 M.	F.	18 M.	F.	19 M.	F.	20 M.	F.	21+ M.	F.	Total Male	%	Total Female	%	Grand Total
0- 19				1		2		1	2	2	3	2	3	4	1	2	3	1		3	1	1	1	1	2			2	18	1.6	20	2.0	38
20- 30	1	4	5	5	9	9	12	18	26	18	23	30	25	39	30	36	25	25	13	19	8	17	8	12	8	2	8	9	201	17.8	243	25.2	444
40- 59	4	7	19	7	20	28	40	33	57	50	69	54	81	74	77	76	54	53	59	27	30	26	27	17	13	14	21	18	571	50.8	484	50.2	1055
60- 79	2	2	11	4	14	11	15	21	33	19	32	28	42	32	52	24	33	21	23	15	13	14	14	8	8	3	13	6	305	27.1	208	21.5	513
80-100		1	2		2		2	1	3		2	2	4		2	2	3		3	1	1	1	1	1	2		2		29	2.5	9	0.9	38
Total	7	14	37	17	47	48	70	75	121	90	128	117	156	146	163	141	116	99	98	65	53	59	51	39	33	19	44	35	1124	99.8	964	99.8	2088
Median	54	48	51	51	51	49	49	53	52	47.5	51.5	48	52	48.5	54	47	52	47	52	48	52	50	50	48	50	48	52.5	48	51		49		50

TABLE 24
Distribution on the Education Test According to Sex

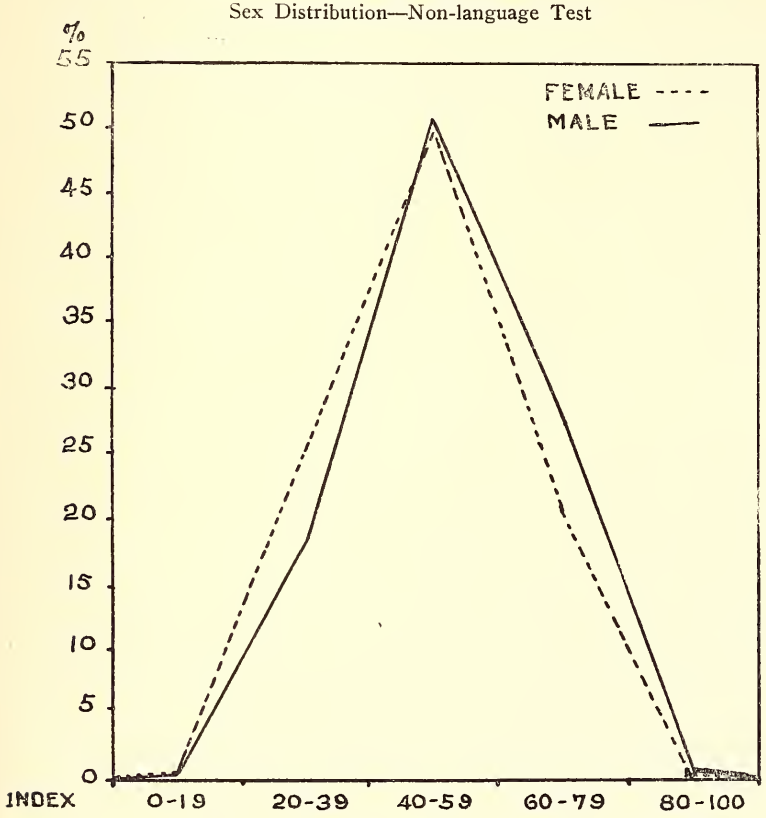
	Age 8 M.	F.	9 M.	F.	10 M.	F.	11 M.	F.	12 M.	F.	13 M.	F.	14 M.	F.	15 M.	F.	16 M.	F.	17 M.	F.	18 M.	F.	19 M.	F.	20 M.	F.	21+ M.	F.	Total Male	%	Total Female	%	Total
0- 19											1	7	2	4	3	3	2		1	3		1	1			1		2	14	1.2	21	2.1	35
20- 39	1	6	13	4	10	11	17	15	29	15	27	25	36	29	34	33	29	28	19	13	11	13	13	8	5	5	8	9	252	22.4	214	22.1	466
40- 59	3	5	11	10	24	24	38	37	59	51	65	57	72	78	76	70	56	42	56	29	25	33	26	18	18	9	21	18	559	49.8	481	49.8	1031
60- 79	2	2	11	3	12	12	15	21	26	24	33	26	45	32	48	32	27	28	20	19	15	12	10	12	8	4	14	5	286	25.4	232	24.9	518
80-100	1	1	2		1	1		2	3		2	2	1	3	2	3	2	1	2	1	2		1	1	2		1	1	22	1.9	16	1.6	38
Total	7	14	37	17	47	48	70	75	121	90	128	117	156	146	163	141	116	99	98	65	53	59	51	39	33	19	44	35	1124	100.7	964	99.6	2088
Median	58	51	48	48	48	51	47	52	50	50	52	48	51	49	52	48	49.5	53	51	43	51	49	49	51	51	46	53.5	47	51		50		50

dex equal to or above the median mental index for the boys, that is ages nine and eleven. Combining all ages, the final medians are 51 for the boys and 49 for the girls.

Figure N makes this slight difference somewhat more apparent. The dotted line representing the girls is shifted a little

FIGURE N

Sex Distribution—Non-language Test



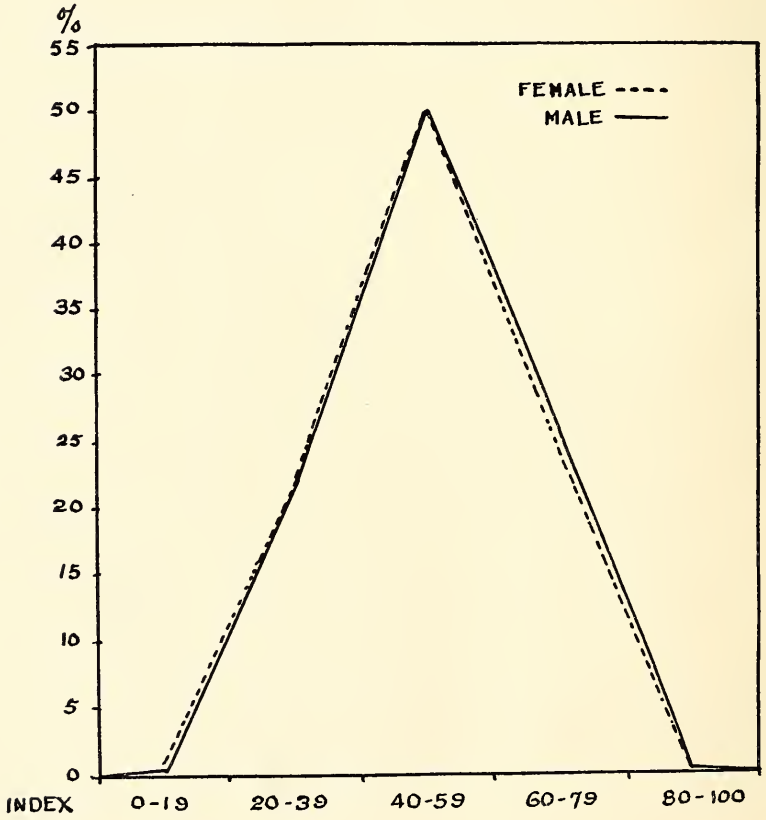
to the left, that is, there is a somewhat larger percentage of our girls falling in the backward group and not quite so many in the bright and very bright groups. The striking feature, of course, is the great similarity of the two curves. The two sexes

are so much alike that we certainly can not speak of a sex difference in mental ability.

On the Educational test we find somewhat more variation within the age groups between boys and girls, that is, we see that at ages nine and twelve the median for the girls equals that for the boys. At ages ten, eleven, sixteen, and nineteen the medians for the girls are higher than those for the boys. However the medians for the two groups, combining all ages, differ by only one point. Figure O shows the curves for the males and

FIGURE O

Sex Distribution—Education Test



females almost exactly overlapping. In educational attainment the two groups are even more alike than in mental ability.

Our conclusion would be that if there is even a slight mental inferiority among deaf girls, it is compensated for by some other factors and that they attain as much educationally as the boys. The mental inferiority of deaf girls as a class is, however, very slight, even if it really exists. If it does really exist to the slight extent indicated by our measurements, then a very slight excess on the part of the girls in such factors as greater conscientiousness in school work, greater docility in school, greater interest in academic subjects, a greater degree of obedience to their teachers would readily account for the equal educational attainment shown by the girls.

CHAPTER XII

Comparison of Deaf and Hearing Children

Before the use of standardized measurements the deaf as a class were considered as having the same general intelligence as hearing people. It is perfectly true that many deaf people have innate ability which far exceeds the mentality of many hearing people. Gradually, however, we are coming to recognize that deafness as a usual thing is accompanied by a somewhat lower degree of general intelligence.

In the case of congenital deafness, the inferior mentality and the deafness are probably due to some common cause, which is an inherited defect.[1] Added to this original defect, is the fact that certain brain centers may never develop, because they have never been used. With adventitious deafness the brain centers probably have developed, since considerable growth occurs in pre-natal life and in the first few years after birth. Pintner and Paterson[2] found in their early work with the deaf, using the Binet Scale, that the average deaf child is about three years retarded according to the norms set by the hearing children. On the Seguin Form Board they found much less difference between the deaf and hearing, although there was more variation among deaf children. The other form board results show the deaf superior in very few instances and then only to a slight degree while the hearing surpass the deaf to a marked degree in most cases. In giving deaf children a mental age according to hearing norms the writers found a retardation of about three years. This would indicate that whatever caused the deafness at the same time caused a lowering of all the factors which go to make up general ability.

[1] Pintner, R., and Osborn, D., "The Mentality of Families of the Congenitally Deaf," *American Annals of the Deaf,* Vol. LXIV, No. 2, March 1919, pp. 96-134.

[2] Pintner, R., and Paterson, D. G., "The Binet Scale and the Deaf Child," *Journal of Educational Psychology,* Vol. VI, No. 4, April 1915, pp. 201-210.

According to Adler[3] deafness is sometimes compensated for by a psychical factor, so that we find great musicians with serious defects in hearing. This theory might perhaps be applied also to some cases of marked brilliancy among the deaf, but it can only be in exceptional cases. It certainly is not the rule.

For comparing deaf and hearing children in visual memory for digits Pintner and Paterson [4]used Smedley's[5] norms for hearing children and also the results of deaf children in the Chicago Schools tested by MacMillan and Bruner.[6] The average number of digits recalled by children of each chronological age, according to Pintner and Paterson's results is very much below that for hearing children of the same chronological age. The Chicago children, although representing a selected group, also show a memory span lower than that of hearing children but at the same time higher averages than Pintner and Paterson's cases, since they find the average deaf child at no time reaching the average ability of a seven-year-old hearing child, while many of the Chicago children surpass this point, although none of them reach the average ability of a nine-year-old hearing child. Pintner and Paterson stress the fact that the abnormally poor memory span of the deaf is due in part to the lack of auditory experience. That is, a hearing child not only sees the digits as they are presented, but he also hears and says them over to himself, and thus uses muscles involved in speaking. These additional sensations are, for the most part lacking in the deaf child.

Deaf and hearing children were compared directly in their ability to follow printed directions.[7] The tests were made on groups of about 275 hearing and 300 to 350 deaf persons. The

[3] Adler, Alfred, "Organ Inferiority and Its Psychical Compensation," *Nervous and Mental Disease Monograph Series,* No. 24, New York, 1917.

[4] Pintner, R., and Paterson, D. G., *op. cit.*

[5] Smedley, F. W., "Child Study Report No. 3 of the Department of Child Study and Pedagogic Investigation," Chicago Public Schools, 1900-1901, p. 53.

[6] MacMillan, D. P., and Bruner, F. G., "A Special Report of the Department of Child Study and Pedagogic Investigation on Children Attending the Public Schools for the Deaf in Chicago," Chicago Public Schools, 1908, pp. 70-71.

[7] Pintner, R., and Paterson, D. G., "The Ability of Deaf and Hearing Children to Follow Printed Directions," *Pedagogical Seminary,* Vol. XXIII December 1916, pp. 477-497.

time was disregarded and the comparisons made as to the number of directions correctly carried out. No age group among the deaf shows a median of more than seven correct answers, while with the hearing children every age group above eight years has a median of more than seven correct answers. That means that a seven or eight year old hearing child has about the same ability to understand and follow printed directions as the fourteen to sixteen year old deaf child. The relative difficulty of the various directions is practically the same for the two groups.

In the case of the Trabue Tests[8] referred to before the great backwardness of the deaf in language ability is emphasized when it is found that even after thirteen years of instruction the average deaf child does not attain the ability of a fifth-grade hearing child.

Figure P gives a picture of the quartiles for the hearing and the deaf children on the Non-language or Mental Tests. The solid lines indicate the 25 and 75 percentiles while the broken lines indicate the medians for the two groups. We find that the 75 percentile for the hearing group is at every age higher than for the deaf group. The 75 percentile for the deaf at three age groups is only equal to the 50 percentile for the hearing but at all other ages lies above the median for the hearing. Ages eight and nine show slightly higher medians for the deaf than for the hearing. The 25 percentiles for the hearing are lower at these ages than for the deaf. This is accounted for by the better sampling of hearing children at these ages. The deaf at these lower ages are selected cases, that is, those who have passed beyond the first grade in school. The cross-hatched section of the chart indicates the degree of overlapping of the deaf and hearing on the mental test. The variation in the two groups is about the same, although at the higher ages the variation is greater for the deaf.

In Figure Q we have a very different picture. This time the quartile scores on the Educational Survey Tests are indicated. In only one age do we find any overlapping. This occurs at age eight where the 75 percentile for the deaf is slightly higher

[8] Pintner, R., and Paterson, D. G., *op. cit.*

FIGURE P

Quartile Distribution of Hearing and Deaf on Non-language Test

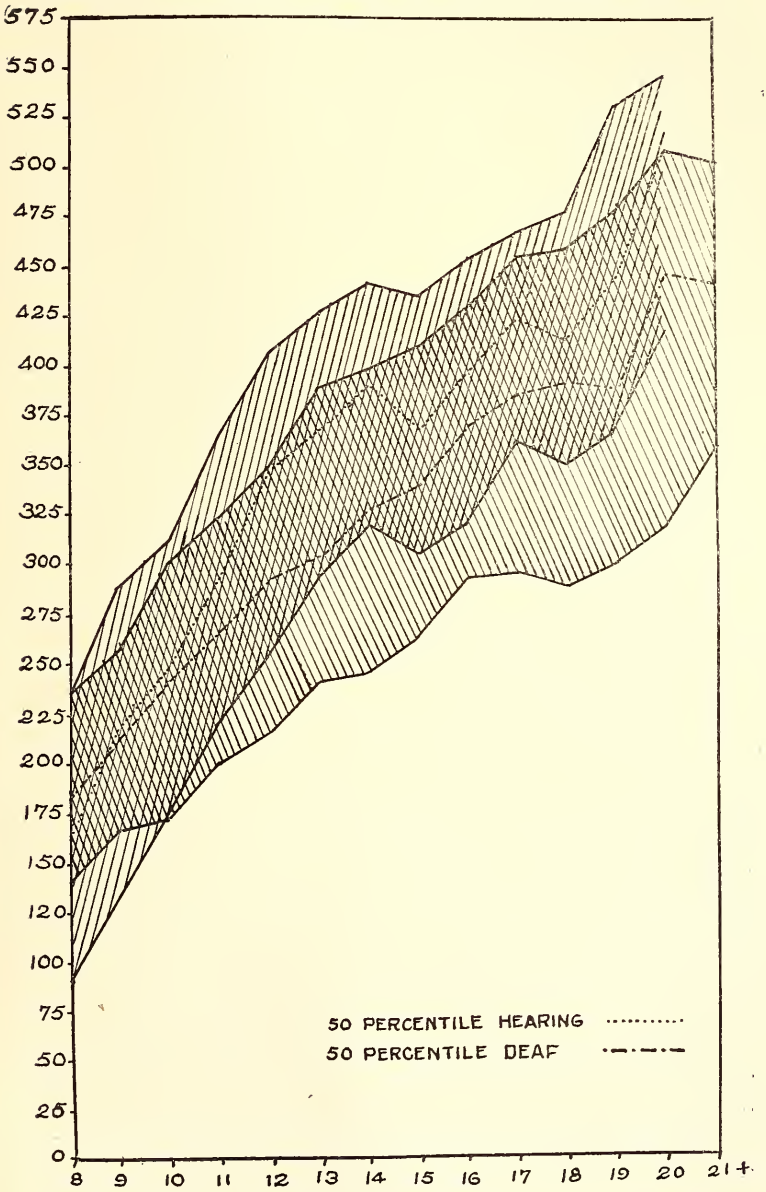
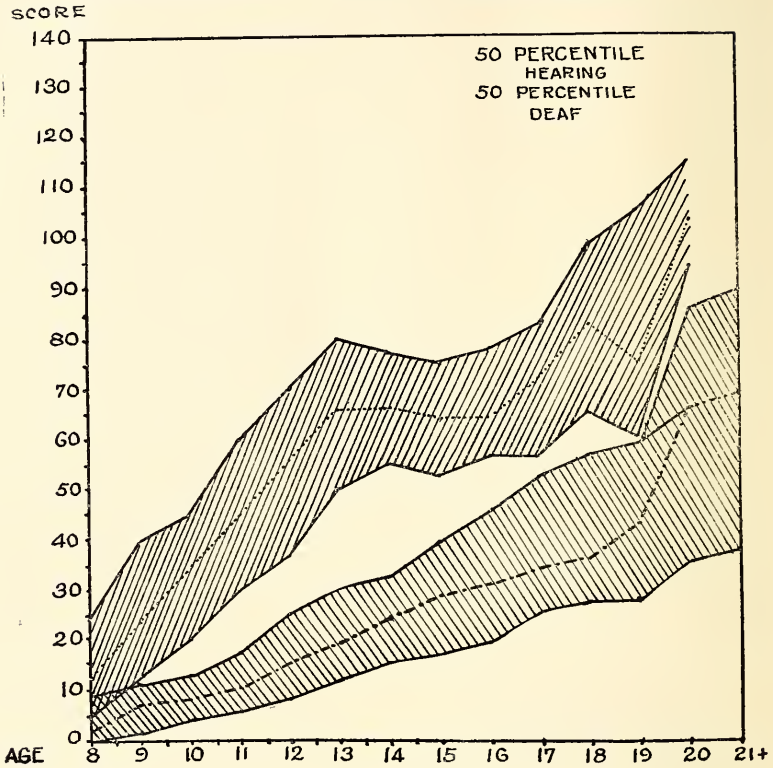


FIGURE Q

Quartile Distribution of Hearing and Deaf on Education Test



than the 25 percentile for the hearing group. The variation at each age is less for the deaf than for the hearing up to age fifteen, then it remains about equal or greater than for the hearing. This bears out the earlier findings that the deaf are below the hearing educationally at all ages. The differences at ages twenty and twenty-one plus probably are not as great as would appear from our curves because of the fact that the norms for the hearing, at these ages, are based mostly on scores made by University students. These scores are undoubtedly higher than they would be if we had a less selected group.

Following the suggestion given in one of Pintner's articles we have given below the grade in hearing school in which we

would find the average deaf child of any given age judging from his score on the Educational Test.

TABLE 25

Deaf According to Grade Standards of Hearing

Chronological Age	50 Percentile Score		Educ. Hearing Grade Rating
8	makes 2	corresponds to	—II
9	" 7	" "	II+
10	" 8	" "	II+
11	" 10	" "	II+
12	" 15	" "	III
13	" 19	" "	III+
14	" 24	" "	III+
15	" 28	" "	IV+
16	" 31	" "	IV+
17	" 34	" "	IV+
18	" 36	" "	IV+ or V
19	" 43	" "	V
20	" 66	" "	VII+
21+	" 68	" "	VII+

The first column gives the chronological age. The second column gives the 50 percentile score (according to deaf norms) for each chronological age. The third column shows about the grade in hearing schools making the median corresponding most closely to the median for the deaf at each chronological age.

For purposes of comparing the grade standing for the deaf and hearing we include the following table:

TABLE 26

Grade Standing for Hearing Children on Educational Test

Chronological Age	50 Percentile Score	Grade
8	13	III
9	24	III+
10	34	IV+
11	45	V+
12	56	VI+
13	66	VII+
14	66	VII+
15	64	VII—
16	70	VII+
17	72	VIII—
18	83	XII
19	75	VIII
20	103	XII

The slower progress of the deaf is very much more evident from this table since more than one age group of deaf children

would fall in any one grade of hearing school. Only the two oldest age groups of deaf attained a rating equal to seventh grade ability of hearing children. This means that a part of the hearing children are from one to five grades ahead of the deaf group, although the hearing are by no means as superior on the mental test.

Our conclusion from comparing the average grade scores for the hearing children with the deaf is that on the whole, the deaf would be three and a third grades below hearing children of the same chronological age.

For conversion of the median educational scores for the deaf into educational ages according to the hearing norms on the educational test we give the following table:

TABLE 27

Educational Ages for the Deaf on the Educational Test According to the Hearing Norms

Chron. Age	Median Score	Educational Age of Hearing	Difference
8	2	6 yrs. 6 mos.	1 yr. 6 mos.
9	7	7 " 4 "	1 " 8 "
10	8	7 " 5 "	2 " 7 "
11	10	7 " 6 "	3 " 6 "
12	15	8 " 1 "	3 " 11 "
13	19	8 " 6 "	4 " 6 "
14	24	9 " 0 "	5 " 0 "
15	28	9 " 5 "	5 " 7 "
16	31	9 " 10 "	6 " 2 "
17	34	10 " 0 "	7 " 0 "
18	36	10 " 1 "	7 " 11 "
19	43	10 " 10 "	8 " 2 "
20	66	13 " 0 "	7 " 0 "
21+	68	15 " 6 "	5 " 6 "
			Average 5 years.

The first column gives the chronological age and the second column the median score for deaf children at each age. The third column shows the educational age according to hearing norms on the Educational Test, for a child making the given score. The last column gives the differences between the chronological and educational age. An average of these differences shows a retardation, in educational age, of five years for the deaf child.

The next table gives the mental age for each median non-language age score for the deaf according to hearing standards.

TABLE 28

Mental Ages for the Deaf on the Non-language Test According to Hearing Norms

Chron. Age	Median Score	Mental Age Hearing	Difference
8	180	8 yrs. 6 mos.	6 mos.
9	219	9 "	0 "
10	242	10 "	0 "
11	262	10 " 6 "	6 "
12	292	11 " 1 "	11 "
13	302	11 " 5 "	1 yr. 7 "
14	325	11 " 7 "	2 " 5 "
15	338	11 " 9 "	3 " 3 "
16	369	13 "	3 "
17	383	14 "	3 "
18	389	14 "	4 "
19	387	14 "	5 "
20	446	19 "	1 "
21+	440	18 " 6 "	2 " 6 "

Average Difference 1 year 10 months.

The first column gives the chronological age and the second the median score on the Non-language Test for each age. The difference between chronological age and mental age is given in the third column. The average retardation in this case is a little less than two years. This is not as great a difference as Pintner has found in most of his results while the five years' difference on the educational test is considerably more.

In conclusion, therefore, we note that the deaf as a group are retarded on the average two years mentally and five years educationally. The mental retardation is probably inherent, due to the lowered mental ability of the group, and it would, therefore, account for two of the years of educational retardation. The other three years of educational retardation must be accounted for by other factors. Undoubtedly the greatest of these is the lack of auditory experience and one is tempted to assume that it is a complete explanation. We must not, however, forget other possible factors, such as quality of teaching, regularity of attendance, age at beginning school, amount of physical illness and the like. We have not made any exact study of such possible factors. From personal observation, however, we should be inclined to rule out quality of teaching, which seems to be every bit as good in deaf schools as in hearing schools. Regularity of attendance would seem as good, if not better, in

deaf schools as compared with hearing schools. As to comparative amounts of physical illness we have no data. There remains, however, age at beginning school. Here there is a marked discrepancy between deaf and hearing. The average age for the hearing child is six or six and one-half years. The deaf child rarely enters school before age eight and in many cases not until age nine. Here, therefore, is a possible additional cause for the marked difference in educational accomplishment, which might help, in part to explain the excess amount of three years' educational retardation. We say "in part," because undoubtedly the great element in this excess of three years' retardation is the language handicap.

CHAPTER XIII

Summary

1. The application of psychological and educational tests to the deaf has only recently been attempted. Much has been written about the education of the deaf during the last four centuries. The measurement of ability and educational attainment is only about six years old.

2. This work is the next logical step in the series of mental and educational measurements of the deaf conducted by Pintner and his students. It represents for the first time an attempt to combine mental with educational measurements, so as to correctly evaluate the one in terms of the other.

3. The tests consist of a Non-language Mental Test, comprising six separate tests, in the giving and taking of which no language is required, and of an Educational Survey Test, comprising eight separate tests, which covers the principal subjects in the ordinary school curriculum.

4. These tests are group tests and were given to about 2500 deaf children, the largest number so far used in any psychological test on the deaf.

5. A standardization of the two tests is based on 2172 cases out of the 2500 tested. All cases used in the standardization took both tests and were deaf children from age eight upwards.

6. The deaf children represent fifteen state institutions and eleven public day schools, in nine different states.

7. The Non-language tests give normal distributions at each age from age eight to age 21+. The Educational tests give normal distribution from age 10 to 18.

8. The medians increase steadily from age to age. The mental test gives plenty of scope to measure all degrees of intelligence in deaf children above age 8. The educational test is too hard to discriminate well below age 10. It will discriminate well for grades 3 and above in the average deaf school.

9. The standardization shows percentile norms for each age

for both tests. Every fifth percentile is shown as well as smaller steps at the two extremes of the distribution.

10. Percentiles are converted into indices to obtain comparable differences at any point of the percentile distribution. The indices allow direct comparisons between the educational and mental scores.

11. The Difference is the algebraic difference between the mental and educational index of an individual or between the medians of any groups.

12. A plus difference greater than ten indicates an educational attainment greater than is ordinarily achieved by a given amount of mental capacity.

13. A minus difference greater than ten indicates an educational attainment inferior to the expectation of the given mentality. It indicates intellectual wastage.

14. Repeated testing of one school after intervals of twenty months and twelve months shows reliability coefficients of .73 and .76 for the mental and educational tests respectively.

15. Specific directions have been worked out and standardized for use by others for giving, scoring and evaluating the tests.

16. A comparison of the schools involved in this study shows glaring differences in the mental caliber and the educational attainments of the pupil material. The mental indices range from 36.5 to 60; the educational from 36 to 74.

17. The Difference values range from +15 to —11, thereby showing schools which are making use of the mental caliber of their pupils on the one hand ranging down to schools in which there is a terrible wastage of good material that is not being made use of in the educational machine.

18. In this last point the institutions tested are more at fault than the day schools. The day schools tested make more of the mental material that comes to them than do the institutions.

19. Appropriate charts are given for the use of the superintendent to compare his schools with other schools and also charts of a diagnostic character for the pupils in his own school.

These charts should help him to locate the weak spots in his system.

20. Diagnostic charts for the use of each teacher are also shown. These show the exact educational and mental rating of every pupil in the class.

21. The tests suggest the crying need for better classification particularly with reference to mental ability; and, also, the great need for coaching teachers and other special means to salvage the intellectual material that is going to waste.

22. A special study of a supposedly deaf day school containing fifty percent of hearing children, shows the pernicious effects of such a mixture of deaf and hearing. It is bad for both groups and should not be tolerated.

23. A comparison of manually and orally taught shows the average mental and educational index of the former lower than the latter; but each group is doing as much as its mentality would warrant.

24. The oral method does not lead to a better comprehension of the written English language as used in the educational tests. Oral and manual children of the same mental caliber do equally well on the educational test.

25. The manual method or teachers fail at present to make as much progress in academic work as is possible with the bright pupils. On the other hand they seem to produce exceptionally good results with the very dullest pupils.

26. The congenitally deaf are slightly below the adventitiously deaf both in mentality and in educational attainments. This is probably more marked than our medians actually indicate because we have included the "unknown" with the adventitious, whereas the larger number of these "unknown" are undoubtedly congenital. The medians of the "unknown" are below the medians of the adventitious.

27. There is practically no difference between the mental ability or educational attainment of the partially and totally deaf whether congenital or acquired.

28. Among the adventitiously deaf, the age of becoming deaf has a great influence on future educational attainment.

Onset of deafness before age six makes no difference in later educational work; onset after age six, however, makes a very significant difference and allows a child to progress, educationally, much faster than he otherwise would have been able to do.

29. The number of males and females tested showed 117.7 males to 100 females. The higher percentage for males has been noted in all accurate census reports of the deaf.

30. There is no sex difference either in mental ability or educational attainment between deaf boys and deaf girls.

31. The average difference in mental ability between hearing and deaf children is about two years.

32. The average difference in educational ability between deaf and hearing can be expressed by saying that the deaf child is retarded five years when compared with the hearing child.

33. The average grade retardation of the deaf, according to hearing standards is about three and one-half grades.

34. The discrepancy between the two years' retardation mentally and the five years' retardation educationally is due to the language handicap, and this is a good measure of the power of this handicap in the education of the deaf.

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